THE YEAR BOOK *of* ORTHOPEDICS *and* TRAUMATIC SURGERY

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With a Section on

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PLASTIC SURGERY

INTRODUCTION

Organized negligence is the cause of most hospital infections' This was the challenging opening statement of one member of a Panel which discussed antibiotics as related to surgery at the Southeastern Regional Assembly of the United States Section of the International College of Surgeons meeting in Miami Beach January 4-7 1959 The alarming increase in the incidence of infections of the wounds following elective operations of supposedly 'clean cases" has demanded careful study of all operating room technics The tragedy of bacterial invasion of the wound after open reduction of a fracture or any other operation on the bones or joints of a patient almost defies description Most of these infections are caused by antibiotic resistant staphylococci which are more often found in the nose or throat than on the skin of the patient or of a member of the surgical team

Greater care must be taken to cover adequately the nose and mouth of each person who enters an operating room This must include the patient the surgeon the anesthesiologist, residents interns and nurses Cultures should be made of the nose and throat of each patient and at regular intervals of each member of the operating room teams Those who are found to be persistent carriers of strains of virulent streptococci or staphylococci should be barred from the operating room until it can be shown definitely that they are no longer harboring these organisms which have proved to be so grave a threat to the life or limb of patients.

Improved prostheses of vitallium or stainless steel better operative technics and more careful selection of cases for prosthesis arthroplasties of the hip appear to be the answers to the question of how to obtain a high percentage of satisfactory end results An accurate fit of the metal femoral head in the acetabulum has been shown to be a primary factor in preventing erosion and wearing away of the weight bearing area of an acetabulum.

Care of the diseases or injuries of elderly patients requires more and more time of the orthopedic surgeon Senile osteoporosis of the spine and malignant tumor metastases to the weight-bearing bones produce pain and pathologic frac-

tures The great decrease in the number of patients crippled by tuberculosis pyogenic osteomyelitis nutritional deficiency diseases and poliomyelitis has been compensated for many times over by the greatly increased number of patients with fractures and other injuries of the spine and extremities resulting from accidents on the highway in the factory and in the home The orthopedic surgeon reluctantly or willingly is ever increasingly becoming a surgeon of trauma.

This is the twelfth volume of the YEAR BOOK OF ORTHOPEDICS AND TRAUMATIC SURGERY that I have been privileged to edit. For me this has been a most wonderful and valuable experience Only because of increasingly heavy commitments in connection with my duties as Professor and Chairman of the Departments of Orthopedic Surgery at Northwestern University Medical School Chicago Wesley Memorial Hospital and the Veterans Administration Research Hospital and as an officer of various surgical societies have I decided that I must relinquish this editorship It gives me much pleasure to be able to announce that my successor will be Dr Ralph K Ghormley Emeritus Professor of Orthopedic Surgery of the University of Minnesota and Emeritus Chairman of the Division of Orthopedic Surgery of the Mayo Clinic. Dr Ghormley is a world renowned orthopedic surgeon and scholar I predict that under his direction this YEAR BOOK will become the most widely read reference book of the orthopedic surgeons of the world.

I again call to the attention of our readers the excellent section on Plastic Surgery edited by Dr Neal Owens Professor of Clinical Surgery at Tulane University School of Medicine This is the second volume in which this section has been added to the YEAR BOOK OF ORTHOPEDICS AND TRAUMATIC SURGERY Comments received about this section have been most favorable

EDWARD L. COMPERE

ANATOMY EMBRYOLOGY PHYSIOLOGY AND PATHOLOGY

Anatomy of Joints of Spine is reviewed by Walter M Dorr[1] (Univ of Heidelberg) The ligamentum flavum connects the vertebral arches which support the articular and other processes and have a characteristic structure in the lumbar area. Between the lateral margin of the yellow ligament and the margin of the vertebral arch there is a recess which is connected with the joint space and is actually an extension of it The recess is bordered by the yellow ligament anteriorly and by the vertebral arch and its margin posteriorly and superiorly respectively laterally it is closed by fatty tissues These recesses are located along the lumbar spine and on the lowest thoracic vertebra They measure about 4-6 mm in height. Besides this superior recess of the joint space there is often an inferior recess in the upper or lower lumbar area or along the entire lumbar spine

In the cervical spine a mucous sac stretches between the vertebral arches from the vertebral joint to the interspinous ligament About 3-4 mm in height it is bordered superiorly and inferiorly by the vertebral arches anteriorly by the yellow ligament and posteriorly by a membrane covered with fatty tissue On the side facing the vertebral joints there is a thin membrane between the joint cavity and mucous sac This membrane usually contains a pinpoint opening through which the joint cavity and mucous sac communicate No mucous sac was found between the occiput and atlas or between the atlas and axis

The author found three types of articular disks The first type was coarse poor in vessels or even avascular the second was loosely built fatty and vascular and the third type found in the lumbar area was larger than the other two and contained vessels and vascular tissues In addition to these disks there were small barely visible villi in the joint recesses It is suggested that the first type be named menisci the second either meniscus like structures or simply joint folds and that the third type be known as fat bodies similar to those found in the knee joint.

(1) Arch. orthop. u. Unfall-Chir 50 222-224 1958

The joint disks are believed to have two functions mechanical protection of the joint surfaces and volume equalization by space variations in the joint cavities

Histologic Changes in Joint Capsule in Congenital, Traumatic and Paralytic Dislocation of Hip were studied by Margret Lange[2] (Univ Orthopedic Clinic Munich) The capsule of the hip joint is subject to various influences and changes It may elongate and assume the form of an hour glass or may appear flat and stretched It may also contract shrink and shorten Its inner surface may enlarge by increased villus formation leading to increased exudation and resorption

The rich vascularity of the synovia explains the effective response of the joint capsule to inflammatory or chronic mechanical stimuli (pressure traction and shearing) In the fibrous layer and especially in the synovial layer perivascular lymphocytic extravasations and localized and diffuse accumulation of lymphocytes were often seen The capillary network of the joint capsule usually responds to irritation by increased vascularization In capsular degeneration the vessel walls often show fatty degeneration of the intima. Endangiitis obliterans of the arterioles leading to histolysis was seen in several capsules

The many nerve endings in the joint capsule account for pain in joint injuries and in certain diseases of the capsule In long standing and severe injuries fatty degeneration takes place in both parts of the capsule In paralytic hip dislocations the normal tissue structure is replaced almost completely by severe fatty degeneration

Several capsules showed implants of cartilage and bone trabeculae proving the ability of the capsular connective tissue to turn into cartilage and bone

The capsule of the hip joint is able to compensate strongly by increasing its thickness four or five times Its regenerative power is also pronounced

Electron Microscope Studies of Crystal Collagen Relationships in Bone IV Occurrence of Crystals within Collagen Fibrils was investigated by Huntington Sheldon and Robert A Robinson[3] (Johns Hopkins Univ) Earlier electron microscope studies revealed the existence of crystals

(2) Ztsch Orthop 90 270-299 1958.
(3) J Biophys. & Biochem Cytol 3 1011 1016, Nov 25 1957

within the collagen fibrils of bone matrix. In fully calcified bone matrix there are no areas which are not replete with crystals This finding indicates that there should be a deposition of crystals not only at the periphery of the fibrils but also within them The position of the crystals along the collagen fibrils was shown by Jackson in sections from incompletely calcified embryonic avian bone Referring to the longitudinally oriented collagen fibrils with attached crystals she suggested that the section plane may pass through the fibrils This implies that crystals could lie within the fibrils

In studying calcifying mouse bones with cancellous bone spicules the authors found that new calcification of bone matrix occurs at the periphery of bone spicules in normal animals A layer of osteoblasts overlies the calcified spicule and the layer of calcifying bone matrix. In hematoxylin stained sections for light microscopy osteoblasts are seen to have an intensely basophilic cytoplasm In the electron microscope this cytoplasm appears to contain densely packed lamellated intracellular membranes most of which appear to have small granules attached to their outer surfaces Such membrane systems have been variously referred to as ergastoplasmic sacs rough-surfaced elements of the endoplasmic reticulum and alpha cytomembranes These membranes have been reported as a cytoplasmic component of most cell types and seem to be most prominent in cells that elaborate protein The arrangement and abundance of these granular membranes in the osteoblast most nearly corresponds to the appearance of this component in the acinar cells of the pancreas The space between the smooth appositive surfaces of the granular membranes appears to contain an amorphous substance which is more dense than the embedding medium The relation of the cell surface membranes to the amorphous substance between the appositive surfaces of the granular membranes and to the extracellular collagen fibrils is particularly difficult to delineate.

The osteoblast is invariably separated by a small distance from the calcified matrix This area contains physiologic osteoid or matrix which is becoming calcified. In this area there are varying amounts of collagen fibrils and of opaque interfibrous substance and varying numbers of crystals indicating calcification In normally calcifying bone matrix collagen fibrils appear to be vested with an opaque coating a

short distance (less than 0 5 μ) from the osteoblast Then within an exceedingly short distance these coated fibrils appear associated with inorganic crystals and the matrix is calcified This has been referred to as the calcification front.

Occasionally two osteoblasts may overlie one another Between such cells collagen fibrils are seen In such an area separated by one cell from the calcification front small crystals may be seen occasionally Near the calcification front crystals are seen most commonly at the periphery of fibrils between tangential fibrils or in crystal aggregates sufficiently large to obscure underlying fibrils

Ultrastructure of Bone Technic of Microangiography as Applied to Study of Bone Preliminary Report is presented by Lowell F A Peterson Patrick J Kelly and Joseph M Janes[4] Injection into the specimen must be as nearly complete as possible The injected material must have sufficient contrast on the x ray film to be easily distinguishable and there must be no disturbance from the bursting of small vessels caused by excessive pressure Once the injection is made the contrast medium must remain in the vessels instead of diffusing through the vessel wall This requirement cannot be met of course where the endothelial lining is incomplete. Appropriate fixatives limit diffusion of very fine injection mediums to a tolerable level for many tissues With large specimens diffusion is marked when a medium such as a 25% suspension of thorium dioxide (Thorotrast) is used. In general varying forms of barium sulfate e.g Micropaque or freshly precipitated barium sulfate suspended in gelatin solution have been most useful for study of the vascularity of cancellous bone and Thorotrast has worked best in the study of cortical bone A microangiogram made by the following method is shown in Figure 1

TECHNIC—Animals are prepared for injection by anesthetization with pentobarbital (Nembutal®) heparinization and exsanguination through the carotid artery The hindquarters are perfused with an isotonic solution to which a vasodilator has been added. When the perfusion is seen to have removed the blood adequately from the hindquarters as determined by the character of the outflow the contrast medium is injected. When Thorotrast is used the limbs are not perfused before injection. Runoff of the injection medium into the venous side of the circulation may be prevented by ligation of the outflow at the desired time before completion of the injection. Injection pressures are measured continuously no one pressure is suitable for

(4) Proc. Staff Meet. Mayo Clin 32 681 686, Nov 27 1957

all purposes. In general, though, physiologic pressures are often sufficient. When heavier concentrations of barium sulfate are used it is at times necessary to exceed physiologic pressures somewhat to achieve more constant filling of the vessels.

When suspensions of barium sulfate are employed as the injection medium, 10% formalin is used as the fixative. After thorough fixation the bone is cut on a milling machine in sections 1 mm. thick and decalcified in 15% formic acid. Thereafter, the sections may be kept in 10% formalin. The frozen section method is used in making slices

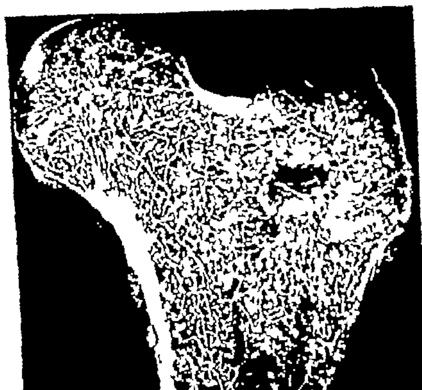


Fig. 1.—Microangiogram of section 1 mm. thick from femur of dog showing epiphyseal and metaphyseal arteries, epiphyseal scar and vascular arcades in head of femur. (Courtesy of Petersen, L. F. A., et al.: Proc. Staff Meet. Mayo Clin. 32:681-686, Nov. 27, 1957.)

of soft tissue or of decalcified bone into which injection has been made.

Target film distances vary from 14 to 22 cm. Empiric determination of exposure data is essential; however, at a distance of 14 cm. with a specimen of decalcified bone 1 mm. thick, generally an exposure of 7-8 minutes is required at 20 kv. and 25 ma. Kodak high resolution plate or spectroscopic plate 649-GH is the film used. The specimen is placed between two layers of Mylar, a Du Pont plastic available in varying thicknesses, to prevent curling of the specimen due to drying and also to provide close contact by means of a vacuum between the specimen and the photographic emulsion. The plastic layer on the top portion of the specimen is the layer that applies the pressure to the specimen holding it against the photographic emulsion.

The films are developed according to the manufacturer's directions with D-19 developer and acid fixative Slight overexposure of the film is attempted it is underdeveloped to keep grain size minimal. This has not resulted in marked decrease in contrast. After the films are washed the emulsion is immediately covered with a glass cover slip in a manner similar to that used for histologic sections. This protects the emulsion and aids cleaning of the slides. Best results are obtained when all solutions are filtered and kept in clean covered, glass utensils Constant agitation during development is helpful in reducing adjacency effects of the photographic emulsion Stereoscopic views can be produced by taking microradiograms or microangiograms at two different angles and then viewing these with a microstereoscope or enlarging them by photomicrographic methods and viewing with a prismatic stereoscopic apparatus.

Ultrastructure and Function of Bone are discussed by Franklin C McLean[5] (Chicago) The unit of bone structure at the microscopic level is the haversian system or osteon This is an irregular cylindric, branching structure with thick walls and narrow lumen known as the haversian canal This canal carries one or more capillaries and venules The cylindric osteons are usually oriented in the long axes of bones Their basic structure consists of concentric layers or lamellae the fibrils of each lamella extending spirally to the axis of the canal The osteon in addition to its canal and fibrillar structure includes many lacunae that house the cells of bone (osteocytes) and interconnect with one another and with the lumen by branched canaliculi In cross section the osteons average about 150 μ in external diameter whereas the canal may not measure more than 20 μ in diameter In length, the osteons commonly extend several millimeters

An osteon is formed by deposit of layers or lamellae of fibrillar bone matrix on the walls of a cylindric cavity or tunnel with subsequent mineralization of the lamellae. After an osteon has been fully mineralized it loses some of its ability to react with body fluids mainly because its constituents are less accessible to the circulating fluids Throughout life compact bone undergoes a process known as haversian remodeling This insures a constant supply of reactive bone accounting for less than 1% of the total bone mass This reactive bone gives the skeleton its function as a tissue.

Electron microscopy of bone is aided by both high and low angle x ray diffraction High angle diffraction particularly with microdiffraction technic lends valuable assist

(5) Science 127 451-456, Feb. 28, 1958.

ance to the study of crystallographic properties of bone tissue Low angle diffraction reveals information about the dimensions of the particles and their orientation Microradiography requires the passage of x rays through thin sections so that differences in absorption of radiation can be recorded on photographic film Whereas ordinary histologic sections of bone do not show differences in the density of individual osteons differences are clearly demonstrated in microradiograms The younger osteons appear less mineralized and consequently less dense than the older ones Attention has thus been focused on the mineralization of osteons, for it is readily demonstrable that the new and less dense osteons account for most of the uptake of radioactive calcium strontium and phosphorus

Results obtained in the study of normal bone tissue by microradiography have been confirmed by microinterferometry Also microinterferometric measurements made on decalcified sections have shown that the content of organic material varies little in osteons indicating that the differences seen on microradiographs depend solely on degree of mineralization The polarizing microscope also gives new and valuable information about the ultrastructural organization of calcified tissue

Most protein present in bone is collagen which is responsible for about 95% of the dry fat free organic content. It occurs in fibers about 800 A wide of indeterminate length characterized by dense cross banding at intervals averaging about 640 A and is generally oriented in the long axes of bones It is in an organic crystalline form capable of refracting x rays

The other organic material of bone about 5% is termed ground substance and fills the spaces between the collagen fibers and crystals of bone mineral Electron microscopic observations indicate that the ground substance has its own organization and ultrastructure The interconnection of the ground substance with tissue fluid by virtue of which the two exist as a continuum permits exchange of ions and other substances with the blood Chemically the ground substance consists of protein and carbohydrates. The crystals of bone mineral are hexagonal tabular forms a few hundred angstroms in length and breadth with a thickness of only a few unit cells

The collagen fibers or part of them are believed to be responsible for seeding and thereby initiating the deposit of hydroxyapatite crystals perhaps by the phenomenon known as epitaxy Bone salt belongs to the apatite series of minerals of which the prototype is fluorapatite $3Ca_3(PO_4)_2 \cdot CaF_2$ The crystalline material found in bone corresponds most closely to hydroxyapatite $3Ca_3(PO_4)_2 \cdot Ca(OH)$

It is convenient to consider the unit of bone mineral at the ultrastructural level as a crystal complex based on a microcrystal of colloidal dimensions only a few hundred angstroms long and 20-50 A thick The crystals have an enormous surface/unit of mass approximately 200-300 sq m /Gm Every ion held on the surface of the crystal is surrounded by oppositely charged ions on one side only the effect is a residual charge or valency on the crystal surface Because of their small size the crystals can attain greater stability almost exclusively by chemisorption This leads to a highly variable surface composition It results also in increased reactivity of the crystal complex Around the crystal and partly bound to its surface are located a layer of hydrated ions and a shell of water which may exceed the dimensions of the crystal itself Synthetic apatite crystals for example may bind 0.8 Gm water/Gm crystals

Where adequate hydration is possible each crystal complex may be viewed as a series of layers Any ion from the surrounding fluids can diffuse into the outer layers of the hydration shell At the crystal surface there is a bound layer of hydrated calcium phosphate and hydroxyl ions constantly interchanging with similar ions in the surface layers of the lattice Within the crystal because of vacant lattice positions a constant though much slower ion interchange takes place Some ions in body fluids can penetrate the hydration shell only (K^+ and Cl^-) some can penetrate the surface-bound ion layer of the lattice surface by displacing calcium phosphate or hydroxyl ions (Na^+ UO^{++} CO_3^{--} and citrate ^{3}) and some can penetrate still further into the crystal interior (Ca^{++} Sr^{++} Ra^{++} PO_4^{3} F^-) All possible ion transfers and movements may be assumed to be constant whe[illegible]er the body fluids are in close contact with the crystal [illegible]plex of reactive mineral

In contrast [illegible]s th[illegible] crystals age and increase in number they gradually [illegible] the water essential to their reactivity

Eventually there remains only a solid inert almost unhydrated mass of crystals and fibers incapable of more than a slight degree of ion exchange or transfer with the body fluids. Such stable bone tissue which comprises more than 99% of the mass of compact bone can be made available to the organism as a whole only by cellular action resulting in resorption.

The parathyroid glands play a decisive role in the regulation of calcium ion concentration in the blood plasma. They are responsible for hourly and daily adjustments but are not in themselves adequate for the minute-to minute interplay between blood and bone. In young animals the turnover of blood calcium may amount to as much as 100%/minute implying that the equivalent of the total amount of calcium in the blood may be replaced every minute.

The parathyroid glands are responsible for monitoring calcium ion concentration in the blood plasma. They respond slowly to changes in calcium ion concentration in the internal environment. By regulating the dissolution of stable bone mineral they help maintain a relatively constant level of calcium ions in the blood. The fine adjustment of calcium ion concentration in the blood i.e., the minute to-minute control is effected by rapid transfers in both directions between the blood and the labile fraction of the bone mineral. Whether this is a purely passive chemical affair by diffusion equilibrium or whether it also is mediated by the parathyroid hormone (as well as by vitamin D) remains as yet uncertain.

Biochemical Studies of Articular Cartilage.—I *Normal values*.—Lillian Eichelberger Wayne H Akeson and Michael Roma[6] (Univ of Chicago) studied the biochemical characteristics in front and hindlimbs of puppies ranging in age from 6 to 25 weeks. The average mass patterns for 1 kg fresh cartilage were as follows. Through age 16 weeks the extracellular compartment consisted of 522 Gm extracellular water and 161 Gm extracellular solids or a total of 683 Gm leaving 317 Gm for the weight of chondrocytes, of which 263 Gm was chondrocyte water and 54 Gm chondrocyte solids. For the older puppies aged 17 25 weeks the extracellular compartment mass was 720 Gm of which 548 Gm was water and 172 Gm extracellular solids. The intra

(6) J Bone & Joint Surg 40-A:142 152 January 1958

cellular compartment or weight was 280 Gm of which 209 Gm was water and 71 Gm chondrocyte solids

The total water content of the tissue decreased in amount from 80% to 75% as the puppies aged. The connective tissue increased in amount from a value of 104 to 159 Gm/kg as the puppies aged whereas the chondroitin sulfate mass decreased from 38 to 23 Gm/kg Though chondroitin sulfate decreased the connective tissue increased enough to enlarge the mass of total extracellular solids from 146 to 181 Gm/kg

The percentage of water in the chondrocytes averaged 83% through the 16-week-old group and 75% in the older age groups

The average concentration of potassium in the chondrocytes was 53 mEq/kg chondrocytes or 66 mEq/kg chondrocyte water The average concentration of magnesium was 35 mEq/kg chondrocytes and 43 mEq/kg chondrocyte water

II Values following denervation of an extremity.—Akeson Eichelberger and Roma[7] studied the biochemical characteristics of articular cartilage from the joint surfaces of the hindlimbs of puppies up to age 25 weeks and 12 weeks after denervation of one extremity The animals were divided into four groups first according to age and second according to the length of time after denervation At first chemical changes occurring in the atrophied tissues appeared rapidly progressed somewhat and then seemed to remain almost stationary In all groups the extracellular solid mass decreased as a result of a decrease in the connective-tissue solids and a marked decrease in the chondroitin sulfate The extracellular water increased markedly as a result of large increases in the ultrafiltrate water The percentage of water in the chondrocytes (the intracellular water) decreased in value.

There was an increase in total water content of the cartilage, resulting from increases in the ultrafiltrate water in the extracellular compartment of the tissue, a marked decrease in the chondroitin sulfate mass and a decrease in the connective tissue mass expressed/kg fresh tissue This resulted from dilution of the extracellular compartment with large volumes of ultrafiltrate water

The percentage of water in the chondrocytes decreased in value from an average normal of 80 to 74 in the young pup-

(7) J Bone & Joint S [illegible] 162 January 1958.

pies with 4 weeks of atrophy after denervation and from 74 in the controls to as low as 60 in the older puppies with up to 12 weeks of atrophy

Effects of Immobilization Atrophy on Histochemical Characterization of Skeletal Muscle Lillian Eichelberger, Michael Roma and Peter V Moulder[8] (Univ of Chicago) immobilized one hind leg of puppies to study biochemical changes in immobilization atrophy in the calf and thigh groups of muscles The opposite leg was used as the control The puppies were separated into three groups according to age and duration of immobilization group 1, age 12 14 weeks with 4-5 weeks of immobilization, group 2 age 13 17 weeks with 6-7 weeks of immobilization group 3 age 17 20 weeks with 8-11 weeks of immobilization Progressive increase in total neutral fat content depending on the length of time of immobilization was observed

The histochemical patterns for 1 kg of these muscles showed increases in the extracellular compartment mass irrespective of age or duration of immobilization due mainly to increased water content in this phase The increased extracellular water was at the expense of the intracellular water Simultaneous with decrease in intracellular water content the solid mass of this phase decreased to such extent that the percentage of intracellular water in the atrophied muscle was the same as that in the sound muscle.

The internal structure of the muscle fibers did not change in immobilization atrophy In all 3 groups of puppies the percentage of muscle fiber water as well as the potassium and magnesium concentrations was the same whether expressed per kilogram of muscle fibers or per kilogram of muscle fiber water in all the calf and thigh groups of muscles from the control and immobilized legs

Quantitative Studies of Precipitation and Agglutination Reactions between Serum of Patients with Connective Tissue Diseases and Preparation (Cohn Fraction II) of Human Gamma Globulin were conducted by Wallace V Epstein Ephraim P Engleman and Margaret Ross[9] (Univ of California) The term rheumatoid factor has been applied to a substance or substances present in the serum of most patients with rheumatoid arthritis This circulating material has

(8) J Appl. Physiol. 12 42 50, January 1958.
(9) J Immunol. 79 441-449 December 1957

also been found in the serum of a few patients with other so-called connective tissue diseases

Rheumatoid factor has been detected by a wide variety of test systems These include those which use sheep or other animal red cells sensitized with rabbit anti red cell serum brucella sensitized with brucella antibodies egg albumin anti-egg albumin specific precipitates and human Rh antibodies on human Rh positive cells The common denominator of all of these systems which react to the presence of rheumatoid factor is the presence of an immune globulin or a closely associated substance from various animal species.

Heller demonstrated that Cohn fraction II of human plasma could inhibit an agglutination reaction between rheumatoid factor and sheep red cells sensitized with red cell antiserum This led to the development of the fraction II agglutination test in which Boyden s method of exposing red cells to tannic acid is used to attach components of a saline solution of human plasma fraction II to sheep cells. These coated cells are placed in serial dilutions of a patient s serum and examined for agglutination after 18 hours at 4 C The underlying nature of the fraction II agglutination procedure was clarified by the observation of precipitate formation when gamma globulin (fraction II) solution was added to serum of high fraction II agglutination titer This reaction could be demonstrated directly as a precipitation reaction or by the use of latex particles which allowed observation of precipitate formation by their inclusion into amounts of precipitate otherwise difficult to observe Heller found that the ability of a gamma globulin solution to coat cells treated with tannic acid could be increased by heating the globulin solution

The authors found that the formation of precipitates on the addition of gamma globulin (fraction II) to the serum of most patients with rheumatoid arthritis is in general correlated with the fraction II agglutination titer of the serum The quantitative precipitation curve of this reaction depends on the fraction II agglutination titer of the serums the lot of fraction II and the volume in which the reaction is performed. The rheumatoid factor and what has been termed the gamma globulin factor probably coexist in serum.

Effects of Sympathectomy on Blood Turnover Rates in Muscle and Bone Jerold M Lowenstein Jacques Pauporte

Victor Richards and Roland Davison[1] (Stanford Univ.) find in the literature that the effects of lumbar sympathectomy on blood flow in the lower extremity are still disputed. It is generally agreed that total limb blood flow is greater after the operation. Debate hinges on the question whether increased skin blood flow accounts for all or most of the change. The worth or worthlessness of sympathectomy in peripheral vascular disease depends on the answer to this question since the usual aim of treatment is to deliver more oxygen to the muscles, not the skin. That opinions have been various and contradictory is partly attributable to lack of a reliable method for comparing blood flow through the muscle, bone and skin areas. The commonly used technics of thermometry, plethysmography and bleeding measure the sum of flow in all three areas in variable degrees. Carbon particles and radiopaque materials have been used for qualitative studies of bone circulation.

The authors studied the effects of lumbar sympathectomy on muscle and bone blood flow in the hindlimb of 17 dogs using an isotopically labeled dye, I^{131} rose bengal, as a tracer. The dye is bound to plasma proteins and does not leave the vascular bed until it reaches the liver, where it is rapidly removed from the circulation. This material was injected by turns into the tibial marrow and the femoral artery, with a gamma ray counter placed over the tibia and fleshy part of the thigh respectively. Under these conditions the clearance rate is the same as the blood turnover rate, the number of times each minute that the local blood pool is replaced by fresh blood. Because the bulk of muscle in a dog's thigh is greater than that of other tissues (skin and bone), turnover rates measured at the thigh were assumed to be largely determined by muscle blood flow.

The average turnover rate in the sympathectomized limb was 27% higher than that in the control limb 1 hour after surgery and 90% higher 1-8 weeks later. In animals with bilateral sympathectomy, no measurements were made on the day of surgery, but blood turnover rates taken over a month later were similar to the later values with unilateral sympathectomy.

These results appear to confirm that blood circulation in

(1) Surgery 43 768-773 May 1958.

muscle and bone of an extremity is augmented after lumbar sympathectomy

► [During recent years the operation known as sympathectomy has been much less popular than it was 20 or more years ago. Demonstration by these authors that the circulation in muscle and bone of an extremity is augmented after lumbar sympathectomy is of great significance. My own experience has shown that lumbar sympathectomy performed with thoroughness improves the circulation of the lower extremity of many patients who otherwise would be subjected to amputation and that the benefits in some have lasted for many years —Ed.]

Rachitomimetic Effects of Fluoride Feeding on Skeletal Tissues of Growing Pigs L. F Bélanger, W J Visek W E. Lotz and C L. Comar[2] fed 12 young pigs for 30 60 and 90 days on a diet containing 1 000 ppm sodium fluoride The animals were paired for controlled study The pigs that were fluoride fed showed defective growth and mineralization of bones costochondral beading, softened and deformed epiphysial plates and enlarged and malformed bone trabeculae.

Histochemical studies of demineralized ribs and heads of metatarsals showed a decrease in the stainable polysaccharides and an accumulation of salt, the solubility of which resembled that of calcium fluoride

Some results of fluoride feeding recalled the classic rachitic syndrome decreased growth decreased and imperfect mineralization hypertrophy of the costochondral junction and overproduction of osteoid. However these may partly represent reactive secondary changes Although the previously laid out portions of the skeleton appeared to be only slightly involved, the bone formed during fluoride feeding was greatly modified in both mineral and organic content Indeed the epiphysial cartilage increased in size and became softer so that weight bearing produced distorted architecture. On the other hand autoradiographic records of tracer doses of $S^{35}O_4$ showed that the tagged sulfate disappeared from fluorinated cartilage at a slow rate and did not diffuse readily from predentine into dentine.

Hypertrophy of cartilage bone and dentine seemingly the result of accumulation and overproduction of an abnormal matrix, is not conducive to animal growth. In bone and dentine this substance appears immature, with staining affinities comparable to those of prebone and predentine.

Only portions of the structural mass presumably those containing salts were dissolved in ammonium acetate a sol

(2) Am. J Path 34 25 35 Jan Feb. 1958

vent of CaF_2. These were the large globular masses observed in bone dentine, cementum and some peripheral connective tissue structures such as tendons and ligaments. It was thought that they were the *Kalkhörner* of Kellner, which are considered responsible for the sclerosing character of the disease.

In the areas of normal mineralization or premineralization a large amount of blue-white ash resistant to acid demineralization and to ammonium acetate appeared in the spodograms. In cartilage this pattern was comparable to that of vitamin D deficiency rickets in children and to strontium rickets in rats. As in these two hypertrophic disorders in the bones of the rats studied there was also an intense uptake of Ca^{45} in vitro. It is thus possible that this diffusely distributed material may represent not CaF_2 but an organic salt of calcium. The existence of an organic precursor to mineralization has been postulated by Sobel. On the other hand others have shown that chondroitin sulfate can behave as a cation exchanger in vitro. It is possible that the blue white ash deposits in fluoride intoxication may represent an accumulation of chondroitin that holds calcium as a loose combination or as a more stable unnatural salt. Thus calcium would be deposited in sites of growth partly as CaF_2, partly as an organic salt accumulating there because normal mineralization cannot occur. The latter condition also seems to prevail in vitamin D deficiency and in strontium rickets.

► [Fluoridation of drinking water in some cities in the United States followed the recommendations of dentists and physiologists engaged in research on the prevention of dental caries. Many physicians, dentists and physiologists warn that the use of fluoride in food or drinking water may be exceptionally dangerous. This article is timely. The authors show that sodium fluoride added to the diet or drinking water of growing young pigs produces definite lesions in the bones.—Ed.]

Repair of Bone Transplant Fractures was studied by Michael Bonfiglio[1] (State Univ. of Iowa) in rabbits. Fresh autogenous-bone transplant fractures in rabbits were found to have the capacity to unite as early as 2 weeks in over two thirds of the animals (Figs 2 and 3). Some of the surface cells of the transplants appeared to survive and proliferate to produce new bone. Graft replacement occurred by creeping substitution. The transplants were well tolerated by host tissues.

Graft fracture healing in fresh homogenous transplants

(1) J Bone & Joint Surg 40-A 446-456, April, 1958.

was delayed by several weeks and less than one third of the fractures united. Marked absorption of the fresh homogenous implant predominated before ossification if any Fresh and frozen homogenous transplants induced cellular inflammatory reaction similar to that described for other homoge-

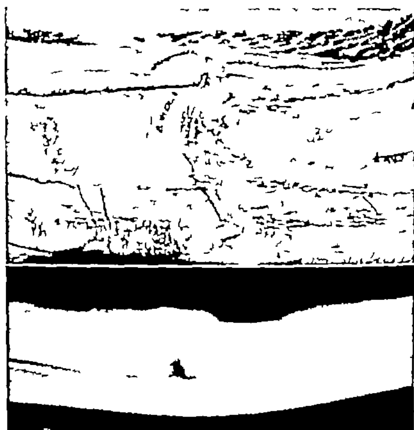


Fig 2 (top) —Two-week fresh autogenous transplant fracture with bone union by intramedullary and periosteal callus reduced from ×9
Fig 3 (bottom) —X ray of total specimen of 4-week fresh autogenous transplant. (Courtesy of Bonfiglio, M. J Bone & Joint Surg 40-A:446-456 April, 1958.)

nous graft tissue Frozen freeze-dried and Merthiolate* preserved homogenous bone implants produced little osteogenic stimulus in the host tissues Graft fractures usually do not unite. These grafts were replaced slowly if at all by fibrous tissue first then by bone.

Fresh autogenous bone transplants are far superior to any other type of bone transplant The repair capacity of fresh autogenous grafts as measured by graft fracture healing exceeds that of fresh frozen freeze-dried Merthiolate*

preserved homogenous grafts or frozen and boiled autogenous grafts Fresh homogenous grafts showed the next best osteogenic repair capacity The pronounced inflammatory incompatibility reaction to the homogenous bone may be detrimental

Roentgenographic Appraisals of Skeletal Growth and Development Reliability and Influencing Factors Harriet J Kelly and Icie G Macy[4] (Merrill Palmer School Detroit) assessed the x rays of 17 boys and 10 girls aged 3 15 years for skeletal growth by the hand standards of Baldwin and Kelly and for skeletal development by the hand standards of Todd and of Greulich and Pyle and the Todd standards for the elbow, knee foot hip and shoulder

The reliability of these standards as applied by experienced scientists was determined by agreement between duplicate ratings of hand development made by one investigator and also by agreement of assessments of hand elbow knee foot hip and shoulder made by two investigators The duplicate measurements agreed within 4 months whereas the ratings of the two independent investigators agreed within 10 months

Skeletal growth and skeletal development may progress independently according to separate biologic time schedules There was less agreement between the two maturation ratings of the hand (growth versus development) than among the development ratings of six skeletal regions (hand elbow foot knee hip and shoulder) Furthermore the differences among the assessments of the skeletal regions varied more than the independent assessments of investigators using the same standard.

Children under age 12 showed characteristic patterns of skeletal maturation For some children patterns of growth and development were similar for others however these patterns differed

For skeletal maturation studies in children it is suggested that the same assessors make all the readings throughout the maturation period. Assessments of growth and development cannot be substituted for one another but each may contribute descriptive information for a broader characterization of the child

(4) Am. J Roentgenol. 80 482-494 September 1958.

Vascularization of Pseudarthrosis Clinical and Experimental Study is reported by R. Roy-Camille[5] (Paris) The clinical material included 8 patients whose condition varied as to chronicity (2½ months to 6 years) and x ray appearance. The lesion of 3 (2½ 3½ and 4½ months after trauma) would be classified as delayed union rather than pseudarthrosis X rays showed pronounced opacity of bone bordering the focus in 3 less extensive opacity in 2 and almost normal osseous transparency in 3 (the most recently affected) In all vascularization as shown by histologic sections was normal or increased being marked in the 3 with radiopaque bone This finding contradicts classic conceptions

Experiments on 12 dogs consisted of producing a surgical fracture which was poorly fixed with too long too short or too thin a nail thus permitting mobility of fractured segments and production of pseudarthroses Both loose and compact lesions were obtained. The latter were of three types In type 1 the ends were perfectly adapted the soft parts uniting the fragments and pseudarthrosis forming a virtual cavity between the two bone surfaces In type 2, the bone was united by a nonossified homogeneous tissue, producing continuity between the two fragments In type 3 the ends were closely adapted and braced at the periphery as in type 1 but with uniting tissue at the center

Microscopically the tissue of union consisted of dense connective tissue rich in collagen and relatively poor in fibroblasts and fibrocytes The structure somewhat resembled that of a tendon or aponeurosis with collagen fibers often folded on each other Interspersed in the connective tissue were areas of chondroid metaplasia visible in the central and peripheral portions of the pseudarthrosis Irregular cavities and zones of fibrinoid necrosis were confined to the central portion Small necrotic bone splinters were found in the immediate vicinity of areas of liquefaction These rarely showed osteoclastic resorption There was no inflammatory reaction no area of ossification connecting the two fragments and no muscular fibers in process of degeneration Vascularization of the tissue of union was abundant, insured by arterioles with relatively thick walls and by numerous capillaries Most of these vessels contained barium oxide In al

(5) J chi 76,372 98 Aug Sept., 1958.

most all instances bone ends were the site of significant osteocondensation due mainly to an intense osteogenic reaction involving the periosteum and medullary cavity. This osteogenesis was sometimes so intense that it almost effaced the cortical diaphysis. It was usually symmetrical and involved both ends of bone equally. Vascularization of periosteal and medullary areas was normal. Some vessels had an open lumen devoid of baryta.

The author believes that the radiologic opacity of bone surrounding the lesion is not a necrosis but an intense osteogenic reaction which involves the periosteum and medullary cavity and produces significant osteocondensation. This is true not only in pseudarthrosis but in all fractures in which reduction is not strictly anatomic. If reduction is perfect healing is per primam without periosteal reaction or intramedullary proliferation. In x rays of these cases the medullary transparency remains normal, bone does not appear thickened and the transparency of the ends is unchanged. With imperfect reduction the bone must fill the gap between fragments and produce an osteogenesis involving both periosteum and medulla. Thus in most imperfectly reduced fractures aside from pseudarthrosis, x rays show the medulla filled and the bone thickened with opaque ends. This appearance persists long after clinical consolidation is achieved and evidently has nothing to do with osseous necrosis.

Aside from the 3 old fluctuating pseudarthroses organized and stabilized as true articulations, pseudarthrosis appears to be a dynamic process undergoing constant change conditioned by etiologic factors and supported by hypervascularization. Pseudarthrosis represents a permanent struggle of the organism to consolidate a fracture despite opposing etiologic factors. So-called different types of pseudarthrosis are perhaps simply different stages. In an early stage reparative osteogenesis is not intense and bone ends are still transparent. This stage may be called delayed union. Later osteogenesis is more active, bone is thickened, the medullary canal is filled and radiologic opacity is definite. Two possible eventualities mark the end of the process: (1) Mechanical factors are so unfavorable that consolidation is impossible and there is isolated healing of the fracture surfaces. (2) If mechanical factors allow sufficient contact between fragments and unfavorable causative factors are eliminated or con-

trolled consolidation is always obtained given sufficient time The aim of surgical procedures is to hasten this union. The fact that the bone surrounding the lesion is well vascularized permits greater optimism and also explains how compression alone may cure pseudarthrosis The causes of pseudarthrosis include poor immobilization repeated or unsatisfactory surgery and poorly tolerated fixation material and infection all of which produce inflammation and its pathologic corollary hypervascularization This last is perhaps the common link between the various causes of pseudarthrosis

Stimulation of Bone Growth was tried by S L Haas[6] (Stanford Univ) in various experiments The lower end of the rabbit s radius was exposed and these metals were inserted into the bone (1) single fragments of iron copper or aluminum in the metaphysis near the epiphysial plate (2) single pieces of the same metals in the epiphysis (3) combined copper and iron in the metaphysis to develop a galvanic reaction (4) copper in the metaphysis and iron in the epiphysis or vice versa to develop galvanic current across the epiphysial plate (5) aluminum in the metaphysis and epiphysis and (6) black manganese oxide in the metaphysis Growth increase occurred only when copper was placed in the epiphysis and iron in the metaphysis Growth loss occurred only with use of manganese oxide which caused a destructive reaction to the epiphysial plate

To have a continual stimulus to the epiphysial plate as growth proceeded the following experiments were performed on dogs (1) The lower end of the femur or radius was exposed and a wire loop passed circularly around the epiphysial cartilage plate (2) Wire loops of different metal were passed laterally and medially to the epiphysial plate. (3) Wire loops of different metals were inserted into the medial and lateral condyles of the femur through the intercondylar notch In each instance there was loss of length growth.

Pituitary growth hormone was placed in small cavities in the end of the radius (1) in the metaphysis near the epiphysial plate (2) in the epiphysis (3) in the epiphysis and metaphysis and (4) in the metaphysis and surrounding tissues near the epiphysial plate In none of these experiments did stimulation of length growth occur

(6) Am. J Surg 95 125-131 January 1958

After the femoral vein and artery were exposed in the inguinal region the vein was ligated Pituitary growth hormones were injected directly into the femoral artery and also daily about the epiphysial plate of the lower end of the femur Length growth did not increase

Haas performed two sets of experiments trying to use the growing epiphysial cartilage plate of one bone to make traction on the epiphysis of an adjoining bone After exposing the lower part of the femur and the upper part of the tibia a wire was passed through the epiphysis of the femur then brought down into the subcutaneous tissue across the knee joint to beyond the epiphysial plate of the tibia The wire was next passed across the shaft of the tibia brought up into the *subcutaneous tissue on the opposite side* and anchored to the other end of the wire at the original starting place It was hoped that with the growth of the tibia there would be traction force on the femoral epiphysis

In the other set of experiments the wire was passed through the epiphysis of the tibia proximal to the epiphysial plate brought up across the knee joint and passed through the shaft of the femur proximal to that epiphysial plate then back to the starting point. Pulling force would be exerted by the growing femoral epiphysial plate on the epiphysis of the tibia. No growth acceleration took place in any of the experiments There was no growth loss

A method was devised for application of direct expansion force about one epiphysial plate. The epiphysial plate of the lower end of the femur was exposed by incision on the lateral *and medial sides of the end of the bone.* A wire or threaded rod was passed through the epiphysis distal to the plate A similar wire or rod was passed through the diaphysis proximal *to the plate. An expansion apparatus was then* anchored to the ends of the wire or bolts on each side. This apparatus consisted of a cylinder containing a wire spring at its base, which was compressed by a plunger inserted into the cylinder Thus constant expansion force was exerted by the compressed spring No acceleration of length growth was obtained by this method No growth loss took place in the bone

Changes Observed in Intervertebral Disk after Discography Ian Goldie[7] (Univ of Göteborg) examined micro-

(7) Acta path. et microbiol. scandinav 42 193-197 1958

scopically 122 disks removed at operation Discography had previously been done on 53 Slightly PAS-positive hyaline droplets were mostly found in the nucleus pulposus into which the opaque material was injected In disks removed at operation without previous discography no hyaline droplets were observed Thus the hyaline droplets are regarded as sequelae of discography

It is assumed that the hyaline droplets consist of chondroitin sulfuric acid and are the result of reaction between the contrast medium and vital disk tissue because the droplets were not found in dead tissues No inflammatory reaction accompanied the hyaline droplets

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CONGENITAL DEFORMITIES

Chondrodystrophia Calcificans Congenita according to Byron G Brogdon and Neil E Crow[8] (Parks Air Force Base) is a rare disorder of infancy characterized by multiple discrete punctate areas of calcification in the epiphyses producing a typical x ray appearance The sites of predilection are the hips knees shoulders and wrists the vertebrae pelvis and rib ends are less commonly involved There are associated changes in the long bones of the extremities (particularly the femora and humeri) consisting of shortening thickening and bowing of the shafts with cupping widening and irregularity of the metaphysial ends Various associated abnormalities may be present.

If the infant survives the punctate densities disappear peripherally in the epiphyses centrally epiphyses more normal in appearance become calcified. These ultimately ossify with a variable degree of residual ranging from marked deformity to relative normalcy The abnormal calcifications usually disappear by age 3-4 years

Anatomically there is a disturbance of vascularization of the epiphysial cartilage and of the cartilaginous anlage of the small bones in the ankle and wrist.

The authors observed the syndrome in 2 infants

Girl, aged 1 day had an extremely flattened nasal bridge at birth with a short neck, short trunk and peculiar curve to the dorsolumbar

(8) Am. J Roentgenol 80 443 448, September 1958.

spine. X ray studies (Fig 4) revealed areas of discrete punctate calcification in the region of the hyoid, at both ends of the humeri and femora and at the wrists and ankles There was stippling of the vertebral bodies throughout the spine The bony nasal bridge was flattened. The humeral shafts appeared somewhat shortened and slightly bowed when compared with other long bones.

A 4-year follow-up showed development of relatively normal appearing epiphyses with peripheral persistence of punctate calcification in some areas. The extremities were not deformed but the carpal and tarsal centers were retarded. There was marked residual deformity of the vertebral bodies, and the skull was considerably dolichocephalic.

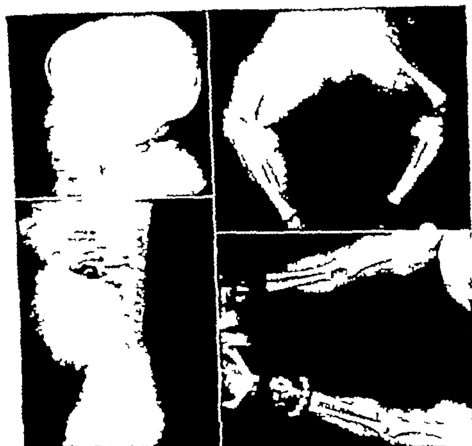


Fig. 4—Typical punctate calcification at peripheral joints and spine. Note flattened nasal bridge and stippled hyoid. (Courtesy of Brogdon, B. G., and Crow N. E. Am J Roentgenol. 80 443-448, September 1958.)

Klippel Feil Syndrome Review of the Literature by V A Canetti[9] (Montevideo) yielded 250 cases reported since the original description in 1912 173 were analyzed as a basis for discussion

This rare syndrome characterized by congenital fusion

(9) Acta neurol. latinoam. 1 118-131 1955

of two or more cervical vertebrae is usually accompanied by other congenital defects of the spine and other parts of the skeleton and in some cases by malformation in other organs The condition appears to be related to a disturbance in segmentation of the mesodermal tissue from which the vertebrae are formed which occurs during the 3d to 8th week of embryonic life The cause is unknown In numerous instances it has been observed in several members of the same family The basic anatomic malformation results in shortening of the spine at the level of the defect Synostosis sometimes extends to the upper dorsal vertebrae Cervical spina bifida and other associated vertebral defects are often present, as well as Sprengel s deformity (upward displacement of the scapula) and malformation of the ribs and of the occipital bone.

Cardiovascular anomalies were recorded in 6 cases (3 4%) though their incidence is probably higher since they were found in 4 (18%) of 22 cases in which autopsy was performed. Anomalies of the buccal cavity palate and teeth are also relatively common

Consistent clinical signs of this syndrome are neck shortening reduced capacity for neck and head movements and a low posterior hair line. These changes vary in intensity according to the degree of osseous malformation Some mild cases may escape detection except by x ray examination

Neurologic complications are fairly frequent. Central or peripheral changes were present in 49 (28%) of 173 cases reviewed and psychic disturbances in 8 (4 6%) These neurologic manifestations consisted of purely or predominantly pyramidal syndromes syringomyelia and syringobulbia, cervicobrachial radicular symptoms changes in cranial nerves Claude Bernard Horner *syndrome* bimanual synkinesis (mirror movements) and deaf mutism

Prognosis is usually favorable with long survival Patients with severe skeletal or visceral anomalies usually die during the first weeks or months after birth

As a rule the bony deformity requires no treatment Bilateral thoracoplasty in the upper thoracic region has been proposed as a means of improving motility of the head and shape of the neck Some associated deformities such as displaced scapula torticollis and webbed neck are amenable to surgical correcti n

Care of Infant with Congenital Subluxation of Hip Paul C Colonna[1] (Univ of Pennsylvania Hosp) reviewed the records of 45 infants with evidence of congenital dysplasia of one or both hips. Seven had dislocation and 38 subluxation Thirty five of the infants with subluxation were under age 6 months.

Much uncertainty and confusion exists in published information as a result of loose usage of the term "dysplasia" to indicate subluxation and/or dislocation especially when subluxations in young children are considered Rarely does a



Fig. 5 (left) —Subluxation under observation over 20 years. Relationship of head to acetabulum unchanged.
Fig 6 (right) —Subluxation untreated for 45 years. Patient extremely disabled. (Courtesy of Colonna, P C. J.A.M.A. 166 715-20 Feb. 15 1958.)

case begin as congenital subluxation and change into a true luxation On the other hand cases of subluxation may remain subluxation over the years (Figs 5 and 6) Though limitation in abduction and asymmetry of thigh folds are important clinical signs they alone are not pathognomonic of subluxation The Ortolani click is probably the commonest finding in early dislocations and in certain subluxations but absence of this sign in otherwise definite cases of subluxation does not rule out this diagnosis If the telescoping sign is present it is more likely to be caused by a true dislocation

The Putti triad—upward displacement of the upper end of the femur a sloping acetabular roof and poorly developed

(1) J A M A 166 715-720, Feb. 15 1958

epiphysial nucleus—should not be necessary to make a diagnosis of subluxation but is pathognomonic of dislocations Measurable upward or lateral displacement of the upper end of the femur is rarely seen with congenital subluxation The sloping acetabular roof is undoubtedly a common finding but the degree of slope presents marked variations and it is hazardous to specify the degree indicative of subluxation. However a slope over 35 degrees in the first 3 months of life does suggest dysplasia and in the next 3 months it should not exceed 25 degrees Infants aged 6-12 months who show an

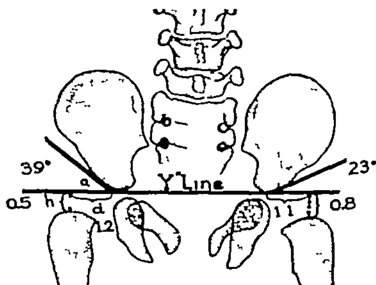


Fig 7—Hilgenreiner chart. (Courtesy of Colonna, P C.: J.A.M.A. 166:715-720 Feb. 15 1958.)

acetabular index of over 25 degrees should be followed up

The femoral nucleus in the normal hip should be visible in the first 3 months of life In patients with subluxations and dislocations it usually is not seen in the first 3 months, though the author has seen it appear as early as 2 and even later than 8 months. Some infants have shown 2 nuclei composing the head which fuse into one and appear normal in size and shape as the child develops The Hilgenreiner chart (Fig 7) is useful but not particularly applicable to subluxation in the newborn

Gradual abduction is the method of choice to correct congenital subluxation The splint most used is that devised by Carruthers and modified by Freiberg (Fig 8) though other types are also satisfactory The Carruthers splint allows full

right angled abduction and external rotation to be accomplished gradually It can be enlarged at the thigh areas and lengthened to fit the growing child The degree of abduction can be regulated by tightening the side strap X rays show the essential feature of forcing the femoral head deep into the socket and retaining it against the floor of the acetabu



F 8 Carruther F ferg plint in position (Courtesy f Colman, P C ... L 166 715-720 Feb 15 1958)

lum permitting the adequate roof to develop when relieved of head pressure against the limbus

The time required for connection varied in the cases reported from a few months to 2 years The x ray and not the calendar should determine the time required to retain the head in the reduced position Most infants used night abduction splints for a few months after round the clock braces were discarded Of 38 patients with subluxations all but 2 regained functional normal hips without operation

► [Congenital dysplasia of the hip is the result of congenital dislocation or subluxation. Proof of this hypothesis is demonstrated by correction of the dysplasia which follows early diagnosis and effective treatment of most cases f subluxation and f many congenital di location —Ed.]

Diagnosis of Dislocation of Hip in Newborns and Primary Results of Immediate Treatment. In 1935 Ortolani described a simple method for detecting congenital dislocation of the hip in newborns by forced abduction which causes a click as the head snaps over the socket wall This method appears reliable but x ray examination is desirable to confirm diagnosis and to evaluate the immediate results of treatment.

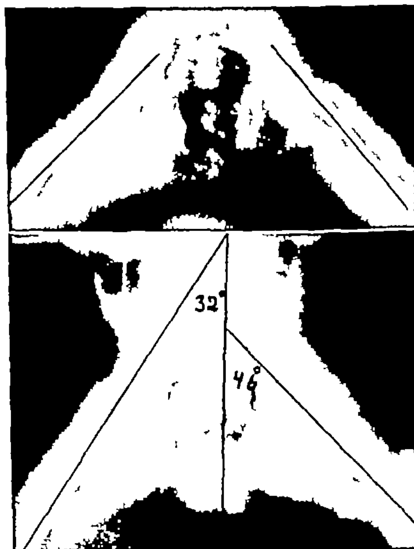


Fig 9 (top) —Postmortem x-ray of newborn with femur abducted and rotated inward. On right side, normal hip, with femoral shaft directed toward edge of acetabular wall. On left side, dislocation with femoral shaft directed toward anterior superior iliac spine. (Ortolani click could be elicited on this side, but not on right.)

Fig 10 (bottom) —Postmortem x-ray of normal infant (arthrogram on left side) showing that abduction appreciably less than 45 degrees can give misleading results.

(Courtesy of Andren, L and von Rosen, S. Acta radiol. 49:89-95 February 1958.)

I. Andren and S. von Rosen[2] (Gen'l Hosp., Malmö, Sweden) developed an x-ray method for demonstrating congenital dislocation of the hip in newborns.

METHOD.—The femora are forcibly abducted to at least 45 degrees with appreciable inward rotation (Fig. 9). This manipulation displaces the head medially with the result that it is forced into or out of the socket, depending on the presence or absence of dislocation. Thus the head never assumes an intermediate position. When the hip is normal, the line of the femoral shaft is directed toward the upper edge of the bony acetabular wall. In congenital dislocation of the hip, the line of the shaft points to the anterior superior iliac spine. Both reference points as well as the direction of the longitudinal axis of the femoral shaft are readily defined. If abduction is less than 45 degrees, x-rays may be misleading (Fig. 10). Further, owing to the marked antetorsion of the femoral neck in newborns, a fair degree of inward rotation of the femora is necessary. If dislocation is marked, with much upward displacement, it may be difficult to secure rotation of the femur, but even with marked dislocation the shaft should be directed toward the iliac spine.

Only if the hip is dislocated at birth can x-ray studies of a newborn be expected to furnish reliable information.

Treatment consisted of placing the child in an aluminum splint to hold the legs abducted and rotated outward, i.e., in a position of reduction. If treatment is started immediately after birth, immobilization of the hip in this position for a few weeks is probably sufficient. It is suggested that dislocation of the hip in newborns is congenital and that hypoplasia is a result rather than the cause of this condition.

► [The authors conclude that "hypoplasia" or "dysplasia," a term more commonly used in the United States, is a result of the congenital dislocation rather than a cause. Proof of this is readily obtained when it is found that, on reduction of the head of the femur of the young infant to its proper relationship to the acetabulum, the acetabulum and the head of the femur each develop until they may become essentially normal. Caution should be exercised in carrying out the Ortolani test for congenital dislocation of the hip in newborns. The authors speak of *forced abduction* which causes a click as the head snaps over the socket wall. We have long cautioned against the use of force in attempting to reduce hip dislocation or in testing for dislocation because of the grave danger of injury to the circulation of or contusion of the head of the femur.—Ed.]

Coxa Valga: Etiology, Symptomatology and Treatment are considered by Hans Georg Hohmann[3] (Univ. of Munich). Coxa valga is of varied etiology. Congenital coxa valga may develop in the following ways: The acetabulum and the femur originate from the same mesenchymal tissues. Before differentiation of a joint space the anlage of the h...

(2) Acta radiol. 49:89-95, February, 1958.
(3) Arch. orthop. u. Unfall-Chir. 49:341-354, 195

is in flexion at right angles and in abduction It turns into adduction only during the 2d to 3d fetal month Pressure on the fetus during this period may change the joint space to such a degree that it may contribute to later deformities

Coxa valga may also be due to rickets In this condition standing places a greater load on the outer part of the epiphysial plate between the femoral head and neck than on it inner part Growth of the outer epiphysial plate is retarded, whereas the medial part develops freely thus leading to a gradual straightening of the neck

Coxa valga adolescentium which develops during puberty may be due to juvenile osteochondritis deformans acute or chronic trauma tuberculosis late rickets or cartilaginous exostoses at the inner aspect of the proximal femoral epiphysis

Traumatic coxa valga usually follows a fracture of the femoral neck

So-called bypass coxa valga is usually seen in amputation stumps when the amputation was performed in childhood or somewhat later Disuse atrophy due to inflammation (coxitis gonitis osteomyelitis osteomalacia) may also lead to bypass coxa valga

Muscular coxa valga is due to extreme muscular pull by the adductor muscles as in Little s disease

X ray studies are most important in diagnosis X ray characteristics include demonstration of an increased angle between the neck and the shaft of the femur and a horizontal or almost horizontal course of the epiphysial line which is occasionally enlarged

The clinical picture is characterized by pain in the hip usually of several years duration The gait is limping and slightly rolling Physical examination reveals a low major trochanter and lengthening of the affected limb the latter being atrophic and slightly rotated outward Rotation is increased by flexion of the hip joint Mobility is limited especially on rotation and flexion

Coxa valga should be differentiated from coxa valga luxans The latter is a congenital hip dislocation with preformed acetabular malformation constituting a so-called late dislocation Apparently often early stages of the disease such as pre and subluxation are overlooked Symptoms are

essentially the same as those in congenital hip dislocation

In the more or less mild forms of coxa valga conservative therapy is indicated such as bed rest during pain and active



Fig 11 (top) —Coxa valga due to coxitis (bypass coxa valga)
Fig 12 (bottom) —Same patient 3½ years after operation.
(Courtesy of Hohmann, H. G. Arch. orthop. u. Unfall-Chir 49 341 354 1957)

and passive exercises if the musculature is weak. However in certain forms such as those with subluxation or dislocation and those due to adductor spasm surgery is indicated. In the adductor spasm form tenotomy alone may produce good functional results There are instances however in which the condition cannot be changed satisfactorily without osteotomy The technic of [illegible]

oblique osteotomy which achieves abduction and interior rotation and turns the femoral neck axis perpendicular to the acetabular entrance in both planes Fixation is secured by screws of Schanz and a pelvic limb cast for 8 weeks. Surgical results are illustrated in Figures 11 and 12

Contribution to Treatment of Congenital Pseudarthrosis of Leg Johann Bösch[4] (Orthopedic Hosp Vienna) observed good bony union when after anterior bowing was



Fig 13 (left) —Pseudarthrosis of leg
Fig 14 (right) —After treatment with compression.
(Courtesy of Bösch J Arch orthop u. Unfall-Chir 49 333-336, 1957)

corrected with good alinement a wedge was cut out of the cast and compression applied With the latter method it is not necessary to obtain complete alinement when the cast is put on However even after the pseudarthrosis was solidified the legs were not ready for weight bearing before age 10-12 Until then they needed braces Minimal injuries to legs without braces led to fractures or insidiously a bony fissure developed On the other hand without weight bearing the affected leg grew almost as fast as the normal leg although the difference in length between the two legs present before wedging remained

(4) Arch orthop u Unfall Ch 49 333-336, 1957

Boy, 12, had undergone unsuccessful bone grafting for congenital pseudarthrosis at age 6, 18 and 24 months. At age 4 years, he was operated on twice, once by the Beck drilling method, the other time by splitting (according to Kirschner) with renewed bone grafting 6 months later all without success. By age 8, the leg had healed well by wedging A year later an accident caused a fracture above the pseudarthrosis in the area of a wire suture. After the suture was removed and a fibular osteotomy performed, bony union was again achieved. At age 10 when he no longer wore any support, a bony fissure developed. The cast and brace were again applied. At age 12 the boy was still wearing them. However an 8 cm. shortening of the leg could not be remedied (Figs. 13 and 14)

► [The author emphasizes the necessity of correcting anterior bowing and advocates the use of compression, after good alinement has been obtained, to obtain union. He reports some satisfactory end results. Apparently he overlooks the factor of a hard, dry white connective tissue which is always found at the site of congenital pseudarthrosis. This almost avascular tissue surrounds, contracts down on, shuts off circulation to the bone ends and produces absorption of bone fragments Compression between the fracture surfaces cannot alone solve the problem of congenital pseudarthrosis.—Ed.]

Treatment of Congenital Absence of Tibia and End Results are discussed by C R. Michel and M Guilleminet[5] on the basis of 10 cases at the Clinic of Pediatric and Orthopedic Surgery in Lyons and 140 cases selected from the literature.

Four patients in the present series had complete bilateral absence of the tibiae in 2 treatment was begun 53 and 18 years previously Four had partial absence (3 unilateral) and have been followed 13 14 and 18 years since treatment was begun Two had congenital atrophy of the tibia 1 patient is still growing and the other with bilateral involvement has been followed 8 years

Diagnosis of absence of the tibia is easy especially when complete. Atrophy of the leg folded in flexion on the thigh and turning of the foot onto the internal leg surface is always characteristic (Fig 15) Foot deformity is the essential sign in partial types (Fig 16) In congenital atrophy there are only limited deformities at birth and moderate equinovarus which may not be noticed for several months X rays confirm the clinical findings

Aims of treatment are to give the malformed leg some supportive function compensate for shortening and preserve the growth potential This involves correction of complex lesions involving the knee leg and foot Treatment must be

(5) Rev chir orthop. 44 125-151 Apr June, 1958.

carried out in several stages Reconstruction of a leg support is the essential feature and methods vary principally with regard to the bone used Operations utilizing the fibula vary with the individual case In total tibial absence the knee presents the first problem Presence of a superior tibial epiphysis and usable knee simplifies therapy in partial cases In operations to establish femoral fibular continuity correction of knee flexion is often the first stage Transposition of the fibula to the femur cannot be accomplished by a simple orthopedic procedure but requires an extra articular approach



Fig 15—Total bilateral absence of tibia. (Courtesy of Michel, C. R., and C Iselin, M Rev chir orthop. 44 125-151 Ap June, 1958)

and mobilization of the fibula which is often difficult. A choice may then be made between femorofibular arthrodesis and pseudarthrosis Bifurcation of the fibula can be used successfully in very young children but seems to inhibit leg lengthening Arthrodesis appears superior to other technics in providing support but is rarely practical in children under 4 From the standpoint of lengthening and retention of growth potential simple transposition of the fibula seems superior because it utilizes immediately the entire length of bone and theoretically does not affect epiphyseal growth In fact several lowering technics often require osseous resection or immobilization in flexion which decreases this apparent advantage

Various operations used in partial absence of the tibia to restore tibial fibular continuity result in osseous fusion after the child has reached age 3 or 4 The axis obtained is gener

ally correct but some valgus deformity usually persists which is more pronounced with lateral anastomosis The knee usually has good function with fibulotibial implantation but may retain limitation of extension With regard to shortening fibulotibial implantation has a theoretical advantage but this is actually lost by the need for resection of a portion of the epiphysis or by immobilization of the



Fig 16.—Partial absence of right tibia. (Courtesy of Michel, C. R. and Guilleminet, M Rev chir orthop 44 125-151 Apr June, 1958.)

knee in flexion Choice of method depends essentially on dimensions of tibial fragment

Autogenous bone grafting is not considered practical in these cases because of the difficulty of achieving a solid support and because of its problematic growth potential.

Restitution of foot support by fibulotarsal arthrodesis poses the problem of approach and utilization of the astragalus In fact, not the method but the purpose should determine the procedure an attempt to restore normal foot position requires one approach placing the foot in a forced equinus position so as to lengthen the leg segment with the foot bones and compensate for shortening requires another This latter method was used in 3 cases of the present series One patient

with partial absence of the right tibia was operated on at age 2½ He could walk without pain at age 17 and 6 cm of shortening of the leg was well compensated for by spontaneous lengthening of the femur and rocking of the pelvis (Fig 17) In a second case the technic was not correct and the result unsatisfactory In the third operation had been performed only 2 years earlier in an infant of 14 months

Complementary methods to correct residual deformities include supracondylar osteotomy fibular osteotomy and secondary foot operations Prosthetic appliances add further

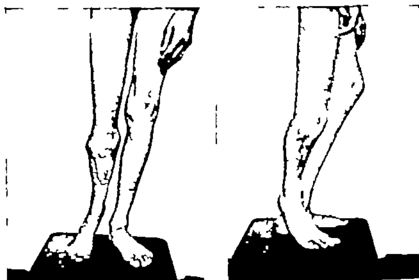


Fig 17 —Result of arthrodesis with foot in equinus position at age 17 (Courtesy of Michel, C. R., and Guilleminet M Rev chir orthop. 44 125-151 Apr June, 1958.)

functional correction The ideal surgical result should eliminate need of a prosthetic device in 3 cases this need was reduced to a minimum

One patient with total absence of the tibia an accountant aged 54 walks to his office. Another died at age 20 but walked satisfactorily and pursued his studies One patient with total absence of the right tibia (treated by amputation) and partial absence on the left (treated conservatively) walks satisfactorily but cannot work One patient aged 17 with partial unilateral absence of the tibia leads an active life plays football and stands at work. Another aged 31 is married has 3 normal children and works actively in her home

In view of these results the authors recommend conserva

tive treatment reserving amputation for the most unfavorable cases after bone growth is complete.

► [The authors have described technics and procedures to salvage the lower extremity of patients born without a tibia. The end results after multiple operations however would not appear to justify the effort put forth by the surgeons or the discomfort suffered by the patients. An amputation at a relatively early age has in many instances resulted in a more satisfactory cosmetic and functional end result. Patients who begin in early childhood to use a prosthesis become so expert in its use that their activities are only moderately restricted. For most of these patients, amputation at an early age would, in my opinion, be preferable to the end result illustrated by these authors.—Ed.]

Congenital Absence of Fibula according to T Campbell Thompson Lee Ramsay Straub and William D Arnold[6] (Hosp for Special Surgery New York) is characterized not only by absence of the fibula but also by tibial bowing deficiency in growth of the extremity and deformities of the foot. The etiology is obscure. The authors review 31 instances of congenital absence of the fibula in 14 boys and 11 girls most of whom were seen first in infancy The oldest patient came for treatment at age 18 No hereditary factors could be identified The lower limb was short in every patient and the femur was often involved in the total shortening At full growth if no effort had been made to equalize the two limbs the difference in length was usually 10 cm or more Within relatively broad limits this discrepancy was predictable if the deformity was typical

Even with surgical correction there was considerable difference in limb length. Talipes equinovalgus was consistently present genu valgum and posterior displacement of the foot occurred less often In many patients the tibia was bowed Anterior bowing seen in 25 patients occurred more often and was more pronounced than medial bowing Although it has been thought that bowing tends to decrease with growth, this decrease was not obvious in the authors series In untreated adolescents anterior bowing of 30–45 degrees was seen A pretibial dimple present in 17 patients at the apex of the tibial bow usually occurred in the severest deformities Tarsal and metatarsal anomalies were present in nearly every patient fusion of the talus and calcaneus was noted in 11 extremities In many patients ossification of the affected extremity was delayed. In no instance was there enough ossification to replace the congenitally absent fibula

In 18 extremities a tight band of fibrous or fibrocartilagi

(6) J Bone & Joint Surg 39-A 1229 1237 December 1957

nous tissue was present in the posterolateral portion of the calf extending from the calcaneus to the upper portion of the tibia This was separate from the tendo achillis which was also likely to be tight in these patients and was often palpable In 11 patients the band was dissected and removed In each case it was found lying in the posterior and lateral area of the calf lateral to the tendo achillis The distal end was firmly attached to the posterolateral aspect of the calcaneus Proximally the band was usually found attached to the lateral margin of the upper portion of the tibia The band was taut firm and inelastic and in several patients contained bits of cartilage or even bone In nearly every patient after division of the tendo achillis the foot could not be brought out of talipes equinus until the band also had been divided The band was always found where the fibula should have been located In several patients tissue resembling the interosseous membrane was present extending from the tight band to the tibia It seems reasonable to assume that this band represents the anlage of the absent fibula

To correct these deformities 28 operations were performed In 10 extremities the tight bands were excised and the tendo achillis lengthened with posterior capsulotomy of the ankle joint when indicated Surgery was supplemented by transfer of the peroneal tendons to the dorsum of the foot in 2 patients Tendo achillis lengthening alone was unsuccessful in 2 patients Tibial osteotomies were done in 5 extremities in 2 of them to facilitate Syme s amputation Amputation was carried out in 8 patients in whom the limb length discrepancy was over 5 in except in 1 child who had bilateral involvement In this patient tibial osteotomies had not provided satisfactory gait or cosmetic improvement. In 2 patients epiphysiodesis was performed on the normal leg One of these operations followed resection of a portion of a hypoplastic fibula in a patient in whom the fibula was only partially absent In general the limb length inequality in these patients was too great to permit equalizing by epiphysiodesis

The band was excised in 10 extremities in 8 patients Three operations on 2 patients were performed too recently to evaluate the results although in each patient the foot could be placed in a corrected position as soon as the band was excised In the other 6 patients (7 extremities) followed 5 15



Fig 18 —Congenital absence of fibula in right leg. Patten brace was worn during period of growth. Limb was shortened 5 in. (Courtesy of Thompson, T. C., *et al.*: J Bone & Joint Surg 39-A 1229-1237 December 1957)



Fig 19 (left) —Congenital absence of fibula in right leg with talipes equinovalgus and bowing of tibia (before surgery)

Fig 20 (right) Same leg 14 years after excision of tight band.

(Courtesy of Thompson T C *et al.* J Bone & Joint Surg 39 A 1229 1237 December 1957)

years results were satisfactory in terms of position o foot The talipes equinus was corrected the valgus defo lessened and the tibial bowing reduced Considerable length discrepancy remained However all could walk ease and enjoy full activity by wearing an elevated sho simple elevated brace (Fig 18) The favorable results doubtless related to the early age at which the band wa cised This operation was performed on children ag months to 5 years most of them under 2

The patient who e legs are shown in Figures 19 a underwent surgery at age 6 months for removal of a melastic band In addition the peroneal tendons we tached to the anterior tibial tendon, and a posterior sulotomy of the ankle joint was performed When the p was examined 14 years later she had a satisfactory po of the foot with no more tibial bowing and enjoyed fu tivity by wearing a raised shoe

► [Amputation at an early age is the operation of choice for thi dition, if it is obviou that shortening of more than 2 in. will be t mate result even if the angulation deformity is corrected. A satis correction of the angulation with a stable foot and anticipated shor after complete growth has been attained, of not more than 2 in. c postponement of any decision concerning amputation. Shortening normal leg after puberty provides an end result which would b acceptable than amputation.—Ed.]

Prognosis of Reduced Congenital Luxations of Hip Surgical Correction of Anatomic Defects J Judet[7] (1 bases his discussion on a follow up study of 50 cases t between 10 and 40 years previously 79 luxations treat thopedically and 49 subjected to surgical procedures.

Epiphysitis is the principal and most serious com tion of hip reduction and it is more frequent (25%) orthopedic than after surgical treatment Treatment c condition is primarily prophylactic consisting of conti extension for as long as possible before reduction reduction and avoidance afterward of the maneuver t the degree of projection and immobilization and avo of the frontal position i e bringing the knee toward th dian axis of the body to the extent that this position is patible with maintenance of reduction

Other complications are chiefly mechanical explain the law of pressure Two are dominant lack of acetabul velopment by pre ure of the subluxated head upward

(7) Rev chir orthop 44 15 175 Apr June 1958

ward and asymmetrical development of the center of ossification in the head of the femur when only its internal part is supported There is in addition a true aplasia of the acetabulum in the untreated infant aged 2-3 years which may persist despite correct reduction

Mechanical deformities of the acetabulum or femoral head have several common characteristics They appear early after reduction 2 or 3 years after termination of treatment and they soon become irreversible. Excision of interposed tissues acetabuloplasty and rotation osteotomies should be performed early to be fully effective. Indications should be precise and no residual imperfection should be tolerated.

From the functional standpoint, results of orthopedic treatment have been superior to those after surgery Orthopedic reduction resulted in normal hips in 57.7% good function in 26 4% and reduced mobility in 14 7% After surgical reduction normal hips were obtained in 17% good function in 44.8% and reduced mobility in 37.9%

Long term study of imperfect reductions has shown that the natural evolution of deformities is toward progression Growth usually accentuates rather than corrects them Change in result is a frequent occurrence in the course of years Deforming arthritis is the end result in many patients sometimes manifesting itself before adulthood. In some cases striking arthrosis of coxofemoral joints occurred when morphology was correctly re-established by treatment but this develops more frequently in subluxated heads incongruent with the cotyloid cavity or placed in anteversion.

Surgical indications are functional and operation of a curative type. Exceptions to this rule may be infants with congenital luxation in whom x ray findings *determine indications* for operation which is often preventive During recent years the author's tendency has been to increase the number of complementary operations e.g acetabuloplasty derotation, etc. whether reduction of luxation has been orthopedic or surgical

A delicate problem is posed in suggesting operation to parents of an infant who has had prolonged orthopedic treatment with generally favorable functional results but knowledge of possible late complications and their severity justifies this advice.

For aplasia of the cotyloid cavity with obliquity horizon-



Fig 21 (top) Congenital luxation at age 2; obliquity of acetabulum.
Fig 22 (bottom) After horizontalization. At age 16 acetabulum almost normal.
(Courtesy of J de J Rev chir orthop 44 152 175 Apr June 1958)

talization of the acetabulum is essential to prevent later complications In 13 of 16 horizontalizations performed during the last 15 years the results have been good with a normal angle and satisfactory development Results in 3 were poor some obliquity persisted in 2 and in the third surgical lower

ing had been insufficient from the outset. These 16 operations were complementary to orthopedic reduction without re excavation of the acetabulum. It is concluded that when the operation is correctly performed the acetabulum develops normally. Points of ossification grow slowly but are maintained in a position to form a roof whose development is similar to that of the normal cotyloid (Figs 21 and 22). Furthermore the femoral head functionally supports this horizontalized acetabulum and develops normally.

Congenital Hallux Varus, according to A. W. Farmer[8] (Hosp for Sick Children Toronto) is a rare condition present at birth wherein the large toe is deviated medially at the metatarsophalangeal joint. The degree of deviation may vary and the anomaly may occur alone or combined with metatarsus varus or even a varus clubfoot. This condition must not be confused with hallux adductus which may accompany metatarsus varus primus deformity.

TECHNIC—The first operations consisted of supplying a skin fat

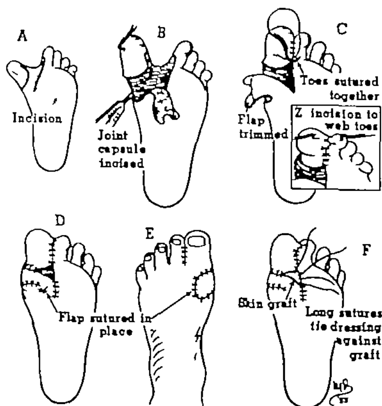


FIG. 23—Steps in operative technic to correct congenital hallux varus. (Courtesy of Farmer A. W. Am. J Surg 95:274-278 February 1958)

(8) Am. J Surg 95:274-278, February 1958

flap for the inner side of the foot to allow lengthening of the soft tissues in this position This is accomplished by a transverse incision of all structures at the level of the metatarsophalangeal joint, entering this joint by cutting across the capsule. The resulting defect is closed by rotating the skin fat flap into it. This flap is obtained from the adjoining sides of the big and 2d toes where there is more than the usual amount of skin It is based proximally and in the first patients was taken from the dorsal surface Later the flap was taken from the ventral surface and rotated in exactly the same manner (Fig 23) Because of the nature of this flap the lateral border is tight as it rotates medially Because any undue tension here is prejudicial to the circulation a small triangular area may be left unsutured and filled with a small free full thickness graft from the patient's flank or from the excess skin of the big toe (when it is narrowed by removing the accessory phalanges and nail) This free graft is positioned at the base of the large and 2d toes where it is not in a weight bearing area To obviate any tendency for the large toe to return to an adducted position it is webbed to the 2d toe This is accomplished by direct suture because the skin has already been removed from these areas. So that the bottom of the web is not a fissure difficult to cleanse a Z plastic maneuver is performed to convert this into a broader groove and allow slight increased motion between the toes. This web is made as far distal as the base of the distal phalanx of the 2d toe.

Postoperatively the foot is immobilized in plaster for 3 weeks. After removal of the cast and sutures no limitations are placed on the patient's activities.

Mobilization of Tarsometatarsal and Intermetatarsal Joints for Correction of Resistant Adduction of Fore Part of Foot in Congenital Clubfoot or Congenital Metatarsus Varus According to Clarence H Heyman Charles H Herndon and Joseph M Strong[9] (*Elyria O Mem'l Hosp*) resemblance of the deformity of the fore part of the foot in clubfoot and in metatarsus varus is so close that the same principles and methods of treatment apply to each condition. At the tarsometatarsal articulations the bases of the five metatarsal bones are firmly bound to the three cuneiform bones and to the cuboid by strong dorsal, interosseous and plantar ligaments The bases of the lateral four metatarsal bones articulate with each other and are firmly bound together by strong dorsal interosseous and plantar ligaments. The operation developed by the authors consists in mobilizing these joints by freely cutting the tarso and intermetatarsal ligaments and joint capsules

Technic —With a pneumatic tourniquet in place, a curved incision is made across the dorsum of the foot, beginning at the medial side of

(9) J Bone & J t S x 40-A 299 310 April, 1958.

the 1st tarsometatarsal joint and extending to the base of the 5th metatarsal bone (Fig 24) The incision may be extended proximally at the medial side to expose the cuneonavicular articulation so that these ligaments may be cut if they also appear to offer resistance to correction The skin flaps are retracted upward and downward exposing the deep fascia covering the tarsometatarsal articulations. The tibialis anterior tendon is identified and protected and attention is given to any abnormality of its insertion.

A longitudinal incision is made through the deep fascia over the 1st

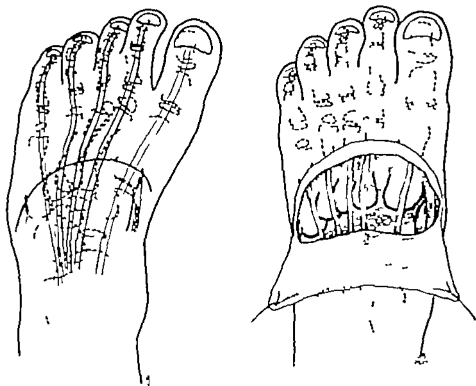


Fig. 24 (left) —Curved incision is made across dorsum of foot. Outlines of fore part of foot and bones are accurate tracings of x-rays.

Fig 25 (right) —Forepart of foot can be abducted to corrected or abducted position without much resistance. Cuneiform bones can also be exposed and ligaments surrounding them may be cut.

(Courtesy of Heyman, C. H., *et al* J Bone & Joint Surg 40-A:299-310 April, 1958)

tarsometatarsal joint. This fascia is retracted, exposing the dorsal ligaments. The dorsal and interosseous ligaments and joint capsule are cut freely by a deep incision carried around the base of the 1st metatarsal taking care not to cut the tibialis anterior tendon at its insertion. The joint is flexed sufficiently so that the knife may be inserted through it to cut the capsule and ligaments at the plantar aspect. Another longitudinal incision is made through the deep fascia over the interval between the bases of the 2d and 3d metatarsals. The articulations of both of these bones can be exposed by retracting the deep fascia A deep incision is made encircling the base of each of these metatarsals and the joint capsules and the dorsal, interosseous and

intermetatarsal ligaments of these articulations are freely cut through. Similarly, a third longitudinal incision is made through the deep fascia over the interval between the bases of the 4th and 5th metatarsals and corresponding ligaments and capsules of these articulations are cut. By exerting traction on all the metatarsals and flexing the tarsometatarsal joints the knife is introduced through each joint to cut the capsules and ligaments transversely at the plantar aspects.

After the ligaments and joint capsules of the inter- and tarsometatarsal articulations are thoroughly cut through the lateral four metatarsal bones will glide on one another and the fore part of the foot will swing outward at the tarsometatarsal joint without much resistance (Fig. 25). If the child is young enough or if the bone deformity has not progressed to a serious degree, the adduction deformity can be overcorrected. The skin is then closed and a well molded plaster cast applied with the fore part of the foot held in abduction as much as possible, care being taken not to evert the heel.

Two weeks postoperatively the cast is changed so the foot may be inspected. The correction may not have been as thorough as was thought and a little more stretching of the fore part of the foot into further abduction may be desirable. Usually this is not necessary. The foot should be maintained in the corrected position in the plaster cast for at least 3 months. Weight bearing and walking in the functional position of correction while the patient is wearing the cast are stimulants toward maintenance of correction after the cast is removed.

The authors performed 29 operations on 20 patients; 9 had operations on both feet. Results were excellent in 19 operations, good in 6. These results could not have been attained by any closed methods of treatment. Results in 3 were fair. In 1 the result was poor; more radical procedure is required to correct the patient's deformity.

THE EPIPHYSES

Early Complications after Osteosynthesis with Three-Flanged Nail in Situ for Slipped Epiphysis were studied by Torsten Jerre[1] (Halsingborg, Sweden) in 66 patients who underwent 79 osteosyntheses in situ. A driving away of the epiphysis by about 5 mm. was noted in 5 patients and of about 1 cm. in 1 patient. No measures were taken to counteract the diastasis. Weight bearing was allowed after a week. In a short time the diastasis disappeared roentgenologically.

Driving away of the epiphysis occurs most readily if the tip of the nail enters the femoral head eccentrically. Direct

(1) Acta orthop. scand. 27:126-134, 1957.

ing the nail against the center of the femoral head decreases the risk of this complication although it cannot be completely avoided with the large Sven Johansson nail In 2 instances the nail did not follow the guide exactly with the result that the guide was bent and when the nail was being driven in was forced in further together with the nail Risk of this complication can be eliminated by careful surgical technic In 5 instances the nail was driven in so far at operation that it slightly perforated the cortex of the femoral head Since the perforation as seen by x rays was so slight that the tip of the nail was regarded as lying within the cartilage of the femoral head without perforating the latter no measures were taken To prevent the nail from losing its hold in the head after growth of the femoral neck as long a nail as possible should be chosen

In 25 cases a definite increase was observed in the distance between the tip of the nail and the cortex of the femoral head It was often impossible to decide by x rays whether this was due to gliding of the nail growth in length of the collum or a combination of both Closer analysis of the films revealed that the increase in distance between the tip of the nail and the cortex of the femoral head in at least 9 instances was due solely to growth in length of the collum To decrease the risk of gliding of the nail the head of the nail should be anchored properly in the cortex of the femur

Subtrochanteric femoral fracture occurred on 3 occasions 2 7 and 12 months after osteosynthesis in association with considerable trauma and while the epiphysial line was still open All healed without sequelae The relatively large defect in the bone produced by the head of a Sven Johansson nail appears to involve such pronounced weakening of bone in this level that later trauma is liable to lead to fracture

► [This is a study of the relatively early end results of treatment of slipped femoral epiphyses by nailing in situ with a three-flanged nail. Displacement of the cap of the epiphysis away from the neck in attempting to insert the nail occurred in 5 patients. Although no complications were noted in the subsequent restudy of these patients, this displacement is certainly not desirable. Hard pounding against the nail would be expected to bruise or contuse the tissues of the hip We have been more optimistic about our results when we have used less traumatic technics, such as insertion of small, threaded, steel pins with a drill instead of by pounding We still believe that the late end results of the treatment of slipped epiphyses by nailing in situ will be osteoarthritis, with or without late aseptic necrosis in a discouragingly high percentage of patients —Ed.]

Slipping of Proximal Femoral Epiphysis 36 Cases Treated by Drilling are discussed by Frits R. Mathiesen[2] (Copenhagen)

METHOD—Drilling is done with a 3- or 4-mm. drill from the out side of the trochanter To secure the correct direction a thin Kirschner wire is inserted first and its direction is controlled by x rays in two projections Then 2-6 drill holes are made up through the epiphysial line. Traction is sometimes maintained during the first postoperative days but otherwise the leg is not immobilized. In a few patients however a plaster spica is applied and maintained for 4-8 weeks At the end of 2 or 3 months the hip is x rayed. If there are signs of incipient healing the patient is mobilized and within the next month allowed weight bearing If incipient healing is doubtful on the film the patient is allowed to move, but without weight bearing i.e. with crutches or a Thomas splint. Thus mobilization is started in all patients 3 months at the latest after operation. Weight bearing however is not allowed until x rays show definite evidence of incipient healing

Follow up averaged 4 5 years During the same period 12 patients with more pronounced displacement had cuneiform cervical osteotomy or reduction complicated by necrosis of the femoral head in 3 Drilling appeared to result in the desired acceleration of epiphysial fusion in all cases but 1 in which erroneous after treatment involved further slipping On the average weight bearing was allowed 3 3 months after operation Despite frequent x rays avascular necrosis of the femoral head was not observed in any patient. So far the clinical result is ideal or fairly good in all However x rays disclosed signs of osteoarthritis in 3 and narrowing of the articular cartilage in 1 The degree of displacement before operation was measured between the center of the head and the axis of the neck in terms of the maximum width in the anteroposterior view or in Lauenstein's projection All patients with displacement of 1 5 cm or less obtained ideal results and show no signs of osteoarthritis

► [It is significant that necrosis of the head of the femur following displacement of the proximal femoral epiphysis has been reported about as often in untreated patients as in those given treatment, including an attempt to restore a more normal anatomic relationship between the femoral head and the acetabulum The authors have treated this series of patients by a technic which appears to aid in restoration of good circulation to the femoral head and in prevention of aseptic necrosis Their technic has not included correction of the deformity which should be of considerable concern to those called on to treat this condition. Excision of most of the remnants of the epiphysial cartilage plate removal of a wedge of bone from the superior surface of the neck of the femur and replacement of the femoral head on top of this freshened and bleeding surface, with maintenance of

(2) Acta orthop scand 27 115 125 1957

position by threaded pins or plaster cast has produced excellent results in patients treated at the Chicago Wesley Memorial Hospital. This restoration of anatomic position, with contact between freshened bone surfaces after removal of the obstructing tissue in the zone occupied by the epiphysial cartilage plate, has also prevented aseptic necrosis in most patients. Only observation of many patients treated by various methods, such as those described by Mathiesen, our own series of patients and others for 40-50 years can give us the information we need on late deteriorating results such as osteoarthritis of the hip.—Ed.]

Epiphysiodesis, according to C P van Nes[3] (Univ of Leiden), is intentional early arrest of growth of an epiphysial disk to reduce longitudinal growth of a skeletal part Consequently it is a therapeutic technic which can only be used during the period of growth The arrest of epiphysial growth can be temporary or lasting

The author reviewed 265 epiphysiodeses performed on 211 patients (for affections of the legs in 205 and for those of the arms in 6) This operation was used for correcting differences in lower limb length resulting from such causes as paralysis congenital anomalies coxitis gonitis war injuries and osteomyelitis and for correction of the sequelae of traumatic affections of the arms In 69% of the cases the difference in limb length was less than 2 cm after completion of growth. In many cases a certain difference in limb length was intentionally retained.

Fracture did not occur in any patient. This is attributable to the fact that a plaster splint was in position for at least the first 6 postoperative weeks which gave the weak spot at the level of the epiphysial disk under treatment time to consolidate. Slight genu varum developed in 1 patient because of a technical error Since the leg was congested during operation there was incomplete visibility of the lateral part of the proximal tibial epiphysial disk which was consequently not entirely scooped out. A slight O position of the leg was seen after a few months Complete restoration to normal was effected by osteotomy at the level of the proximal tibial epiphysial disk and scooping out of the remaining lateral part of this disk. No peroneous nerve injury or infection occurred Overcorrection was seen in 1 patient in whom epiphysiodesis above and below the knee was inadvertently carried out when only epiphysiodesis below the knee was intended

In calculating the time of epiphysiodesis differences between various types of shortening were taken into account

(3) Arch. chir neerl. 9:371 383 195

(1) a fixed reduction of limb length such as that caused by overlapping of healing fracture fragments or a stabilized luxation of the hip and (2) progressive reduction of limb length as in poliomyelitis

Determination of the time and site of epiphysiodesis offers little difficulty in fixed reduction in limb length If there is a fixed reduction of 3 cm e g due to a fracture then arrest of growth of the proximal tibial epiphyseal disk provides an equalization of 0 9 cm /year Complete equalization of the difference in limb length will therefore require 3/0.9=3.3 years The epiphysiodesis should thus be performed 3 3 year before growth is completed i e at just over age 12 years

Progressive shortening must be considered in poliomyelitis This is calculated as follows poliomyelitis at age 1 at age 10 the shortening is 3 cm (1/3 cm /year) the increase after age 10 until completion of growth will be 5½ × 1/3 = 1.8 cm this is a total shortening of 4 8 cm Epiphysiodesis below the knee insures an equalization of 0 9 cm /year The entire difference is therefore 4 8/0.9=5 5 years Epiphysiodesis should therefore be performed 5 5 years before completion of growth—at age 10

The author believes epiphysiodesis below the knee is to be preferred It is technically the least difficult operation as considerable ischemia can be attained at this site This is necessary if the depth of the epiphyseal disk is to be inspected accurately There is more difficulty with the distal femoral epiphyseal disk In this region there is often congestion that impair visibility because many of the large veins of the bone marrow have their exits at the level of the greater trochanter and cannot therefore be compressed by the ligating band

► [In selected cases epiphysiodesis is to be preferred to the use of staples or any other known method of correcting inequality of bone length This is an excellent end result study of a large series of patients treated by epiphysiodesis —Ed]

End Results in Epiphysiolyses and Upper Arm Fractures at Proximal End in Children and Young Adults are presented by H Budig[4] (Graz Austria) Review of 185 infratubercular humeral fractures and 40 epiphysiolyses in patients aged 0-18 years revealed that almost half had considerable displacement and axis deviation at the end of treatment Epiphysiolyses were commonest in patient between

(4) Arch orthop u Unfall Ch 49 521 531 1958

atures Early in the disease isolated instances of vasoconstriction may occur in various areas of skin However these alterations are not consistent and are probably not of great moment Likewise significant warmth may be noted during the first 4 months of poliomyelitis but changes are insufficient to indicate primary involvement of the sympathetic nervous system Vasoconstriction of significant degree occurs in the skin and muscle during the convalescent and chronic stages of the disease Thus the appearance of coldness of the skin and muscle is related to the degree and duration of paralysis Significant changes that show a consistent behavior do not occur until 5-6 months after the initial stages of the illness The great toe did not follow the circulatory pattern of the rest of the extremity No significant alterations in circulation in this area were observed early or late in poliomyelitis

The absence of early changes in skin and muscle temperatures and development of coldness and circulatory changes only after a considerable interval are strong evidences that alterations in circulation are not a primary effect of poliomyelitis on the sympathetic nervous system Lack of response of the great toe either early or late is further evidence The colder paralyzed extremity is capable of vasodilatation and on the reflex vasodilatation test reaches a level of warmth comparable to that of the normal side. A similar vasoconstrictive response to applied cold can also be elicited. These findings indicate that the sympathetic nervous supply is intact after poliomyelitis and that by some unknown mechanism the vasoconstrictor tone of the peripheral blood vessels is increased.

Paralytic Dislocation of Hip Darius Flinchum and C E. Irwin[6] (Atlanta Ga) have observed that most patients with paralytic hip dislocation had the acute phase of poliomyelitis early in life usually under age 2

Sequelae of muscle imbalance play an important role in later development of dislocation of the hip The adductor and external rotator muscles of the hip are usually stronger than the abduction and internal rotator muscle forces Sometimes however when the hips are identically flail one will dislocate and the other will remain in the acetabulum

Flexion abduction contracture of the opposite hip may

(6) South. M J 51 115 1160 September 1958.

cause a fixed pelvic obliquity and anterior tilt of the pelvis thus producing an increased slant of the acetabulum and hip instability

Excessive external femoral torsion of varying degree is usually present and if of sufficient degree in itself produces instability of the hip Coxa valga may be more apparent than real when this rotation is corrected (Fig 26) However, true increase of the angle of the femoral neck can develop over a period of time from lack of abductor pull and incorrect stress of weight bearing

Rotational femoral osteotomy was done on 7 patients with paralytic hip dislocation Average age at operation was 9 1



Fig 26 (left) —Dislocation of right hip with right lower extremity in neutral degree of rotation. Note apparent coxa valga.

Fig 27 (right) —Same patient 2 years after femoral derotation; hip remains clinically stable.

(Courtesy of Fllechum, D., and Irwin C. E. South M. J 51 1157 1160 September 1958.)

years the follow up time 5 4 years In 1 patient the hip promptly became dislocated on removal of plaster immobilization This hip dislocation did not reduce on internal rotation and skeletal traction was needed to obtain reduction

When unfavorable imbalance of the hip muscles or pelvic obliquity is present, one should frequently test for stability of the hip by rotating flexing and pushing upward and posteriorly If on internal rotation the hip is stable, a derotation femoral osteotomy should be considered (Fig 27)

Tendon Transplantation in Foot after Poliomyelitis in Children. J Mortens P Gregersen and L. Zachariae[7] (Or-

(7) Acta orthop scandinav 27 153-163 1957

thopaedic Hosp Copenhagen) treated 102 feet in children who had had poliomyelitis using early tendon transplantation to prevent or minimize deformity and to improve function Ages at surgery ranged from 2½ to 12 years The average time between onset and operation was 2 years Two principles were applied reinforcement of weak antagonists and transplantation of the main deforming muscle Where possible these principles were combined.

Surgery was successful in about half the patients In deformities of medial cavus and equinovarus the operation was almost uniformly successful whereas only about half the calcaneous deformities could be repaired. In the planovalgus group less than a fourth of the children were improved

In selected cases of partly paralyzed feet tendon transplantation is considered useful in restoring muscle balance and reducing deformity in children

► [This is an excellent presentation of evidence that early tendon transplantation should be considered in children with progressive deformities of the feet as a result of imbalance between the various muscular attachments. The authors show that such treatment minimizes deformity and improves function if cases are wisely selected. Tendon transplantation cannot be depended on to correct fixed deformities present at the time of operation. Such deformities should be corrected before the transplantation —Ed.]

Sensory Disturbances in Hands of Children with Cerebral Palsy were studied by Mihran O Tachdjian and William L Minear[8] in 96 children Sensory disorders were found in 40 (41.7%) The three most common sensory defects in order of frequency were astereognosis impairment of two-point discrimination and position sense In addition some patients were unable to distinguish numbers traced lightly on the skin and were deficient in weighing perception localization of tactile stimuli sharp and dull discrimination hot and cold discrimination and length measurement.

An end result determination was made based on the hands of the 96 children All had had extensive physical therapy Surgery mostly multiple operative procedures was performed on 15 of the 40 children with sensory defects

1 The contracted spastic muscles were released and, whenever possible transferred to cerebral zero muscles. This was done in 15 patients The adductors of the thumb were released in 6 The insertion of the pronator teres was

(8) J Bone & J nt Surg 40-A 85 90 January 1958.

sectioned and transferred to the extensor carpi radialis longus and the extensor carpi radialis brevis in 8 patients The flexor carpi ulnaris and the flexor carpi radialis were released and transferred into the extensors of the wrist and into the extensor digitorum communis in 7 patients

2 The wrist was fused in a functional position in 2 patients

3 A bone-graft block was made between the 1st and 2d metacarpals and the thumb brought in abduction and optimal opposition in 1 patient

The end result determination was made 1 9 years after surgery Before surgery the 15 hands were rated in regard to function as follows 5 fair 9 poor and 1 none. After surgery there was no noticeable functional improvement in the 10 hands with sensory defects rated poor or none These hands were so markedly impaired because of total involvement of the extremity that it was doubtful if the patients could learn to use them after surgery The 5 hands rated fair before surgery did not show appreciable functional improvement The extremely impaired sensation in these hands no doubt adversely affected the outcome. Before undertaking surgery on the hand affected by cerebral palsy the motor and sensory status of the involved upper extremity and of the patient as a whole should be carefully evaluated

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OSTEOMYELITIS AND OTHER INFECTIONS

Roentgen Manifestations of Torulosis (Cryptococcosis) are described by John N Wolfe and George Jacobson [9] (Torula histolytica (Cryptococcus neoformans) is a fungus of worldwide distribution. It is usually a saprophyte but it may become pathogenic There were 21 patients with torulosis at the Los Angeles County Hospital between 1945 and 1956 The torulae are usually thought to gain entry through the respiratory tract then spreading to involve other body parts Although various organs may be affected the pulmonary osseous and central nervous systems are involved most often Infection is not considered to be transmitted from man to man or from animal to man.

(9) Am J Roentgenol. 79 216-227 February 1958.

An outstanding feature of the disease is the tendency to form masses composed almost solely of organisms, often with little or no inflammatory response. The lesions as noted in the various organs are for the most part uniform. They are usually discrete, often solitary, but may be multiple. Size varies from several millimeters to 10 15 cm. They are not surrounded by a fibrous capsule as are granulomatous lesions due to tuberculosis; however, demarcation from normal to abnormal tissue is abrupt. The consistency is usually gelatin



Fig. 28 (left). Destructive lesion in right ischium; slight periosteal reaction is present.
Fig. 29 (right).—Destructive lesion of upper pole of patella with surrounding soft tissue abscess.
(Courtesy of Wolf, J. N., and Jacobson, G.: Am. J. Roentgenol. 79:216-227, February 1958.)

ous because of the overabundance of capsular material. The lesion is often confused with that of neoplasm. There are no characteristic clinical features of the disease and diagnosis can be made only by recovery of the organism. The disease may be rapidly fatal or extend for 12 15 years.

The x ray findings are nonspecific and may vary from segmental, fine, lacelike infiltration limited to one or two interspaces to dense consolidation. Lesions with the appearance of masses which may be mistaken for primary or metastatic peripheral neoplasm occur. The x ray features of the bony changes are characterized by a limited area of destruction with slight periosteal reaction (Figs. 28 and 29). Distribution is apparently unpredictable, involving the ischium, tibia and patella. Differential diagnosis primarily concerns tuber

culosis other fungous diseases and primary and secondary neoplasm

Tuberculosis of Hip in Children Seven Years Use of Chemotherapy F Harwood Stevenson J A Cholmeley and H I Jory[1] (London) report results in treatment of 31 patients Of 25 with intra articular disease 18 were treated conservatively and with chemotherapy during their initial attack 3 were treated similarly for relapse and 4 were treated by operation in addition to chemotherapy and conservative treatment Of 6 patients with extra articular disease, 2 received chemotherapy and conservative treatment without operation and in 4 the bone focus was curetted under chemotherapy cover

Of the 18 with intra articular disease treated for the first time conservatively with chemotherapy 9 retained full range of movement 1 almost full range and 1 flexion of 100 degrees Failures include 1 who retained only 30 degrees of flexion and 6 who proceeded to fibrous ankylosis Of the 3 treated in relapse 1 retained 130 degrees of flexion Failures in initial treatment with chemotherapy superimposed on routine conservative management were due to delay in starting chemotherapy too short a period of conservative treatment failure to drain associated extra articular disease and traumatic reactivation Over-all results were much better than those obtained before chemotherapy and average hospitalization period was half that necessary before chemotherapy was available.

Of the 11 patients successfully treated 8 had erosion of the femoral head or femoral head and acetabulum They were all under age 10 at onset Each exhibited a cap of subchondral new bone on the surface of the femoral head after treatment a finding not noted by the authors in pre-chemotherapy days

Of the 6 patients with extra articular disease 4 retained full movement and 1 retained 120 degrees and the other 90 degrees of flexion. Average length of treatment was one third that required before chemotherapy was available.

In the present study operation on closed bone foci under chemotherapy cover presented no danger and experience confirms the logic of such drainage. In some patients the curetted cavity was immediately filled with live bone chips This procedure with chemotherapy is considered risk free

(1) Tubercle 38 164-174 June, 1957

the right middle finger presented a hard fusiform, moderately tender swelling of the base of the proximal phalanx which was about twice the size of the normal neighboring fingers The bony swelling was of sufficient size to limit flexion of the proximal interphalangeal joint from 15 to 20 degrees X rays of the hand (Fig 30) revealed a symmetric uniform cystic swelling involving the proximal half of the proximal phalanx The cortex was uniformly thin but unbroken. The tumor appeared to lie directly against the epiphysial plate, but the epiphysis itself was not involved At surgery the cortex of the proximal phalanx was soft thin and expanded The cystic cavity contained

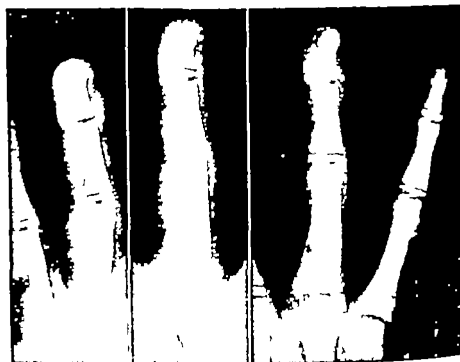


Fig 31 —Hand 16 months after the removal of cyst and the use of bone chip in cavity
(Courtesy of Mason M L, and Wheelock M C Quart. Bull. Northwestern Univ M School 32 268-271 Fall, 1958.)

some blood and reddish granulomatous tissue. Hemorrhage was minimal. The cavity left by removal of the tumor mass was filled with cancellous bone chips. The material removed was an aneurysmal bone cyst. Figure 31 shows the hand 16 months later

At operation the enchondroma can be ruled out on gross appearance alone whereas differentiation between giant cell tumor and aneurysmal cyst must be made on histologic study

Extraosseous Localized Nonneoplastic Bone and Cartilage Formation (So-called Myositis Ossificans) Clinical and Pathologic Confusion with Malignant Neoplasms. According to La en \ Ackerman[4] (Washington Univ) my

(4) J Bone & Joint S 1 \ 2 9 298 April, 1958

-ositis ossificans is a poor term established by custom for a group of lesions appearing in the soft tissue that may or may not be associated with periosteum There is no inflammation and often no bone and sometimes no muscle involvement in the pathologic process The classic localized lesion of myositis ossificans occurs particularly in young and vigorous men participating in sports such as football and is not difficult to evaluate

Geschickter and Maseritz described 25 patients (21 males) with circumscribed myositis ossificans 15 gave a history of injury The thigh was involved in 14 The earliest physical finding was a doughy mass present within a few hours of injury The first evidence of ossification was a small dense shadow in the soft tissue some distance from the bone. Bone could be seen as early as 3-4 weeks One recent patient showed calcification in 19 days This bone lesion was often surrounded by a gelatinous substance within which was a fibrous capsule Cystic changes were found occasionally De generation of muscle, hyperplasia of connective tissue and organization of hemorrhage were early findings Cartilage was seen at times

Calcification is not present in the beginning but occurs later after formation of the osteoid. The osteoid finally develops into well-oriented bone As Constance pointed out, increasing amounts of alkaline phosphatase are produced during evolution of the process but are not a primary cause of the changes If biopsies are done when the pathologic changes are clearly seen well-oriented bone will invariably be present. Lesions are commonest around the knee in the quadriceps femoris and anterior third of the arm involving the brachialis It is significant that these muscles originate from a plane surface contiguous to the bone over a wide area. It seems certain therefore that the periosteum participates in the process

Lesions associated with the periosteum have often been reported as myositis ossificans In the past periosteal bone proliferation was considered evidence of a malignant neoplasm It is well known that the proliferation is merely a manifestation of some underlying pathologic process which can be caused by infection chronic osteomyelitis syphilis trauma subperiosteal hemorrhage eosinophilic granuloma leukemia and primary and metastatic malignant tumors

Often it occurs in neuroblastoma the sclerosing type of osteosarcoma and in reticulum cell sarcoma In some of these conditions the clinical history and x ray findings are sufficient to make a diagnosis Amputation should never be done for a lesion of a long bone without preliminary biopsy a illustrated by the following case

Boy 15 was hospitalized because of a soft tender mass on the wrist He had been run over by a sled 2 months before and injury was followed by pain. Five weeks before hospitalization a small nodule was noted on the volar surface of the radius This greatly increased in size X rays showed a soft tissue mass associated with considerable periosteal bone proliferation. Biopsies revealed hemorrhage in the subperiosteal area. Further investigation showed that the boy had an obscure blood disease This blood dyscrasia together with trauma was sufficient to indicate the cause of the mass. The patient was not operated on and x rays 2 years later revealed only slight thickening of the cortical bone Biopsy saved the patient needless surgery

It is suspected that the pathogenesis of myositis ossificans is related to injury that the injury causes death of muscle and that death of muscle is followed by progressive alterations in the tissue which are microscopically distinctive. Death of muscle does not necessarily result in myositis ossificans but may result in increased fibrous tissue and tumor like proliferation Three patients so affected were seen in whom diagnosis of sarcoma was considered

In rare instances fibrous tissue proliferation associated with periosteum in the subperiosteal zone may be accompanied by extremely cellular proliferation difficult to evaluate. Even in such areas zone phenomena should be watched for Zone phenomena are not present in soft tissue sarcomas though there is pseudoencapsulation

In lesions in atypical locations forming large masses the pathologist and orthopedist should suspect myositis ossificans Often there is no history of trauma and diagnosis must be established mainly on the basis of pathologic findings with emphasis on zone phenomena In seeking the latter one must remember that different degrees of maturation exist with the best-differentiated zone on the periphery

► [About 25 years ago the amputated leg of a young high school athlete was sent to th bone pathology laboratory of one of our great universities for definitive tudy and diagnosis. The clinical and roentgenologic diagnosis had been sarcoma Dissection and microscopic study proved this to be myositis ossifican A more careful evaluation of the history relative lack of symptoms and the x ra could have spared a splendid young athlete the loss of his leg —F]

seen supplying the tumor and almost immediately large veins are noted draining the tumor area The shunts within the tumor are massive and the large veins densely opacified All malignant bone lesions also showed arteriovenous shunts outside the tumor area and even distal to it As inflammatory bone lesions do not show any abnormal vascularity arteriography can assist in differentiating such lesions from tumors

Most malignant soft tissue tumors showed increased vascularity similar to that of malignant bone tumors An irregular network of vessels of varying caliber and irregular outline is characteristic. Areas of tumor which showed a tumor stain were often seen Some tumors such as Kaposi s sarcoma (Figs 32 and 33) showed no network of abnormal vessels only solid tumor stain indicating that all vessels filled were small and numerous In that instance a cineroentgenographic study showed the artery supplying the vascular lesion and the vein draining it almost simultaneously

Most benign avascular tumors are cysts although lipomas myxomas and hematomas produce an indistinguishable appearance The tumor is well outlined with normal vessels displaced and following a smooth course over the surface of the tumor which often is spherical No abnormal arteriovenous shunts are visible either within the tumor or the rest of the extremity

Most benign vascular tumors are vascular hematomas. No veins were demonstrated simultaneously with arteries and no irregular tumor stain was seen in an arteriogram of an endotheliofibroma

Significance of Venous Phase in Arteriographic Studies of Bone and Soft Tissue Tumors Robert Schobinger Ru Kan Lin and Herschel C Moss[6] (Roswell Park Mem'l Inst., Buffalo) did angiographic studies in 70 benign and malignant bone or soft tissue lesions X rays were obtained at 1 second intervals by seriograph with the first of 12 exposed at the end of the injection For the upper extremities and thigh 30 cc contrast medium was used and for the lower leg 40 cc The contrast material was a 50% solution of sodium acetrizoate (Urokon® sodium) for the first 60 examinations The other examinations were carried out with a 50% solution of sodium diatrizoate (Hypaque® sodium) which was better tolerated by the patient.

(6) Cancer 11 115 320 M Apr 1958.

All benign lesions showed a normal arterial phase Although most of the benign lesions also showed a normal venous phase a small group of histologically distinct lesions showed x ray retention of contrast medium during the venous phase These were benign giant cell tumor osteitis fibrosa cystica aneurysmal bone cyst and nonosteogenic fi-

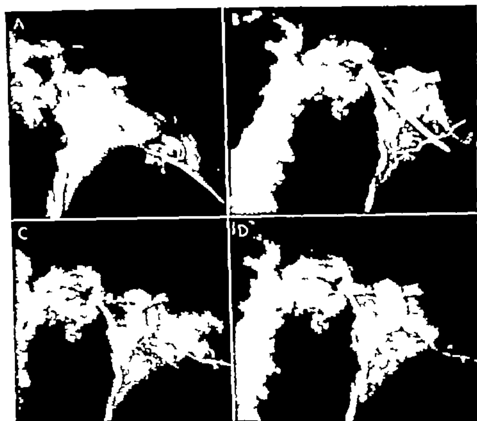


Fig 34—Multiple benign osteochondromas. A plain x rays. B arterial phase normal vascular pattern. C capillary phase vessels in area of lesion appear normal. D venous phase no retention of contrast medium. (Courtesy of Schobinger R., et al. Cancer 11:315-320 Mar Ap., 1958.)

broma The degree of radiopacity in the venous phase appeared to parallel the presence of giant cells in number and location rather than the relative histologic vascularity of the corresponding lesion

Most but not all malignant neoplasms exhibited an arterial pattern characterized by the presence of tumor vessels Absence of abnormal vessels during the arterial phase did not preclude pathologic angiographic findings during the venous phase (Fig 34) Most malignant tumors primary or metastatic showed retention of contrast medium during the

venous phase which was short or only moderately pronounced (Fig 35) Only reticulum cell sarcoma of the bone and Ewing's sarcoma appeared to retain contrast material over long periods of time and in a manner that was peculiarly intense

Some observations appeared to support the hypothesis that giant cells originate from the reticuloendothelial sys-



Fig 35 —Osteogenic sarcoma of distal femur A plain x-ray showing osteolytic destruction of lateral condyle with small amount of new bone formation and soft tissue mass. B arterial phase of femoral arteriogram. Vessels leading to area of neoplasm appear tortuous, increased in number and remained of the same caliber over some distance C capillary phase Moderate amount of puddling of contrast medium within tumor Evidence of arteriovenous shunt is shown by visualization of vein proximal to neoplasm (arrow upper right); but tal vein still empty of contrast medium. D venous phase Only slight residual puddling (Courtesy of Schobinger R et al Cancer 11 315 320 Ma Apr 1958.)

tem considering as a criterion the retention of contrast medium The same holds true concerning the possible relation of Ewing sarcoma to reticuloendothelial elements

Eosinophilic Granuloma of Bone Report of Two Cases with Vertebra Plana. Kaleva Korttila and Lauri Meurman[7] (Univ of Turku) followed 2 patients with multiple eosinophilic granuloma of bone from onset of the disease until healing Histologic studies were performed at different stages of the disease When eosinophilic granuloma is localized in the spine it can be diagnosed early by means of

(7) Acta orthop scandinav [illegible] 114 195[illegible]

x rays from the typical deformity of the vertebral body—vertebra plana—perhaps less than 2 weeks after onset If other bones are involved diagnosis is more difficult in incipient affections it is difficult even histologically Eosinophilia is not present in the blood until 3-6 months after onset Blood chemistry and bone marrow studies do not help in diagnosis Serum electrophoresis however seems to show a slightly elevated alpha₂ globulin fraction and a relatively low gamma globulin fraction

Trauma may play a part in the etiology of eosinophilic granuloma. A traumatic adrenal affection may produce the initial reaction Bacterial and viral infections are evidently not responsible for eosinophilic granuloma

Microscopically a classic change in the histopathologic picture was noted that paralleled the progress of the disease in 1 patient the phase of histiocytic accumulation was followed by massive infiltration of eosinophilic granulocytes and subsequently by fibrosis In the other patient treated with ACTH and prednisolone the histologic picture was atypical for some time and not until several months had passed were features of incipient eosinophilic granuloma noted i e a slight accumulation of histiocytes in the affected site Possibly ACTH and prednisolone inhibit the development of the process arresting it in the initial stage In both patients the histiocytes contained a pigment which was not iron but reduced silver The clinical and x ray findings in both patients corresponded with the observations in Calve s infant patients who had been treated for tuberculous spondylitis until he discovered the new disease vertebra plana

The authors do not suggest any relation between eosinophilic granuloma and Hand Schuller-Christian or Letterer Siwe disease but rather consider the former an independent condition

► [This excellent article, with review of the literature, adds more information about the clinical problem and suggests a classification of eosinophilic granuloma of bone The report of 2 more cases of eosinophilic granuloma, with the development of vertebra plana, adds something more to the suggestion that this may be a cause, or *the* cause, of the condition described by Calvé as vertebra plana.—Ed.]

Central (Medullary) Fibrosarcoma of Bone. W Scott Gilmer Jr and G Dean MacEwen[8] (Univ of Tennessee) reviewing 227 primary bone tumor cases during 1930-

[8] J Bone & Joint Surg 40 A 121-141 January 1958

found a central or medullary fibrosarcoma in 15 men and 7 women Most patients were in the 2d 3d and 4th decades. The distal portion of the femur was involved in 45% and the proximal portion of the tibia in 32% All but 1 patient had had pain lasting 3 24 months 13 patients had noticed a mass 2 12 months before seeking aid Examination revealed a pathologic fracture in 5 patients

On x ray examination the lesion appeared lytic, with irregular indefinite moth-eaten margins. Marginal sclerosis as well as expansion of bone was seen only in the lower grade tumors some of which were trabeculated. Destruction of the cortex was not uncommon in the more aggressive tumors Vague to well-defined patchy sclerosis was observed, with periosteal reaction generally noted but never marked. Often x ray studies did not indicate the extent of the bone tumor involvement

Periosteal reaction never pronounced was more common in the aggressive tumors In the lower grade tumors the cortex was often expanded and thin with and without focal areas of destruction The bone involvement was centered about the metaphysis but epiphysial and diaphysial involvement were common

Of 17 patients on whom amputation or disarticulation was done in only 1 was there local recurrence Two received irradiation along with amputation 3 Coley s toxin and amputation 2 irradiation alone and 1 curettage alone

Nineteen patients were available for final analysis of results The over all cure rate was 26 3% 5 patients being alive and well 15-25 years after operation If however the 2 with slow-growing tumors were not considered the cure rate dropped to 17 6% Of those who died the survival time varied from 3 to 61 months (average 14½ months) In this group only 1 lived over 2 years without evidence of metastases Thus it seemed that a patient who survived for 2 years had an excellent chance of being cured. Of the 3 patients who received Coley s toxin 1 lived 61 months the others were living and well at the time of the report

Giant Cell Tumor of Bone was studied by Vernon R. Gee and David G Pugh[9] (Mayo Clinic and Found) in 58 females and 46 males aged 12 71 Pain was present in 98 and swelling in 78 In 88 cases a mass was palpable Eighty four percent

(9) Radiology 70 33-45 January 1958.

of the tumors occurred in long bones of the extremities Of these 71% were adjacent to the knee

Lichtenstein s estimate of the over all prognosis of giant cell tumors was supported by the behavior of tumors in this series Total removal of the tumor (amputation or complete excision of the involved segment of bone) was curative in each of the 22 patients in whom it was undertaken Most tumors were treated by curettage chemical cauterization and insertion of bone chips into the cavity About half the patients received supplementary ionizing radiation therapy Persistent activity or recurrence (one or more times) requiring further treatment was observed in 44 patients (42%) Radiation therapy as administered did not reduce the recurrence rate. Radiation alone was successful in controlling several recurrences but was unsuccessful as a means of control in the 12 patients in whom it was the initial treatment

Histologic study showed malignancy in 9 patients In 2 initial examination revealed areas of fibrosarcoma in otherwise typical giant cell tumors In the other 7 malignant lesions were found 4-14 years after the original diagnosis of giant cell tumor All 7 patients had received radiation therapy before the malignancy was demonstrated

The typical x ray picture of giant cell tumor consists of an expanding area of rarefaction situated eccentrically in the end of a long bone in a young adult Exceptions to this however were common in the authors patients Expansion was absent or questionably present in 23% The tumor was centrally located within the involved bone in 22% Nearly 35% of patients could not be classed as young adults The most constant finding was tumors located in the end of the involved bone A trabeculated appearance was a prominent feature in slightly less than half the patients

Giant cell tumors involving flat bones lack distinguishing x ray characteristics Lesions in the pelvic bones are easily obscured and may be difficult to detect In some instances the initial x ray appearance could not be correlated with the course of the disease after treatment and the variation in microscopic features

► [The authors clearly demonstrated that excellent x rays of a bone lesion may provide a more accurate diagnosis than biopsy microscopic sections The wise clinician will insist that the history clinical findings, x-ray and microscopic section must agree and fit together before acceptin diagnosis If the microscopic section does not confirm the clinical i

sion additional ti ue should be obtained. Varied microscopic pictures may be *found within or adjacent to a neoplasm of bone* A biopsy specimen should include a significant amount of the tumor No radical surgery should be carried out and no deci ion not to do surgery reached without microscopic evidence which confirms other tests and clinical findings —Ed]

Vertebral Osteoclastoma with Spinal Cord Compression was observed by Norman Whalley[1] (Swansea Wales) in 3



Fig 36 X-ray show ng tumor i girl 12, arising in left half of body of 10th dorsal vertebra Tumor als olves pedicle tran erse proces and half of lamina. Trabeculation is w ll arked Amount f t mor from xtradural plane may be judged from extent of laminectomy (Courtesy of Whalley N Brit J Surg 45 364 372, J nuary 1958)

females aged 12 29 and 1 youth aged 16 The osteoclastoma was verified hi ologically in each Figure 36 shows the x ray appearance of the tumor Surgical decompression of the spinal cord supplemented with deep radiation therapy was performed in 3 1 patient received radiotherapy alone. All made good rec very Radiotherapy alone can produce remarkable results in o teoclastoma of the long bones Recalcification usually occur gradually and progressively over 1 2 years

(1) Brit. J S rg 45 364 3 1 1958

Osteoclastomas are relatively uncommon tumors and their incidence is probably about half that of the malignant primary bone tumors In gross appearance an osteoclastoma tends to be uniformly red or dark red In parts it may be gray or of fleshy consistency In advanced untreated patients areas of hemorrhage and necrosis may be noted In the long bones the affected end is expanded and the tumor is delimited by a thin shell of bone The microscopic appearance is characteristic The field consists of fusiform or rounded cells and multinucleated giant cells together with complete absence of signs of osteoid or bony differentiation The picture is unlike that of any other bony tumor

Juvenile Unicameral Bone Cyst Roentgen Reappraisal is presented by Gwilym S Lodwick[2] (Univ of Missouri) This

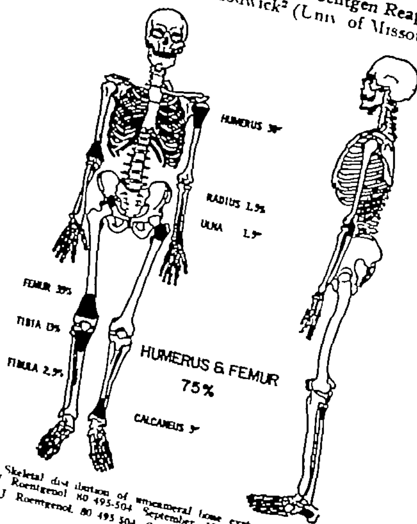


Fig 1 Skeletal distribution of unicameral bone cyst. (Courtesy of Lod
Am J Roentgenol 80 495-504 September 1958.)

[2] Am J Roentgenol 80 495 504 September 1958.

bone cyst comprises but a fraction of a host of roentgenographically cystic appearing lesions practically all of which are tissue filled and surrounded by sclerotic bone By contrast the unicameral cyst is fluid filled and a true cyst. It arises principally in the metaphyses of tubular bones juxtaposed to the epiphyseal plate It occurs most frequently at age



Fig. 38 —Early unicameral bone cyst with pathologic fracture Diameter of cyst does not exceed that of epiphyseal plate (Courtesy of Lodwick, G. S. Am. J Roentgenol 80 495-504 September 1958.)

10 the incidence tapering to a very low level after 30 Average age of the patient with bone cyst is 15 years and the ratio of boys to girls is 3 1 The lesion is usually found in the proximal ends of the humerus and femur (Fig 37)

The x ray appearance of the cyst epitomizes the static, benign cystic lesion of bone Its diameter is no greater than that of the epiphyseal plate (Fig 38) and its shape is that of an elongated truncated cone with the base at the epiphyseal plate in contrast to the round or oval shape of the bone tumor or aneurysmal bone cyst These features suggest that the cyst walls are not actively expanded, but rather are maintained at status quo

Differential diagnosis of juvenile unicameral bone cyst is based largely on the absence of penetration of the cortex and the juxtaepiphysial position of the cyst

The presence of the cyst in the metaphysis apparently blocks the normal remodeling mechanism, which is reactivated when the epiphysial plate grows away from the cyst or when the cyst is successfully treated. The normal diameter of the bone is eventually restored

The mechanism responsible for the origin of the juvenile unicameral bone cyst may be some temporary aberration of the normal physiologic process in the region of the epiphysial plate such as excessive osteoclastic activity

Cysts Confined to Long Bones Anatomicopathologic Study and Surgical Treatment. J Lefranc and C Nezelof[3] examined material from 28 patients observed during the past 15 years in two pediatric surgical centers in Paris The lesion was in the humerus in 19 femur in 7 and tibia in 2 The metaphysis usually the superior was the portion of bone affected generally in the immediate neighborhood of connecting cartilage. Epiphysial localization is unknown and diaphysial localization exceptional (in 1 case the osseous cyst was situated at the union of metaphysis and diaphysis) Osseous cyst is a disease of childhood and early adolescence Most patients were aged 4-13 with male predominance (21 cases) The youngest patient was 3 and the oldest 59 (probably with a long-standing previously unrecognized cyst)

Surgical exploration of the cystic area usually reveals a bone cortex which is thin and easily broken especially in the humerus The cortex is somewhat thicker and less fragile in femoral lesions The cyst is usually unilocular and contains a yellowish or serohemorrhagic fluid. In 2 cases it was empty in 2 it contained a small foreign body free in the cavity and in 1 a greenish mucoid substance The internal wall of the cyst is rarely perfectly smooth and is covered by a grayish conjunctival membrane which often can be peeled away from the bone Consistency and density of bone forming the cystic wall are unequal The superior pole is formed by fragile spongious bone the inferior metadiaphysial pole is limited by hard, dry bone forming the classic bottom of the egg-cup This was not observed in all cases in 2 the osseous cyst communicated directly with the medullary canal

(3) Rev chir orthop. 43 385-406 Oct. Dec., 1957

Operative bleeding usually is slight and only a small amount of material is recovered by curettage

Histologically the lateral walls of the cyst consist of osseous tissue of pitted texture unlike haversian bone or normal spongiosa Osseous lamellae limit the narrow medullary spaces devoid of hemopoietic cells and confine the distended vessels to the pitted walls The periosteum appears normal and usually shows no excessive osteoblastic activity The internal portion of the walls in contact with the membrane shows remodeling with newly formed lamellae and osteoclastic resorption The intracystic conjunctival membrane is a pseudomembrane comprising a matting of unequally compressed collagenous fibers fibroblasts and fibrocytes which adhere irregularly to the osseous wall usually more closely at the two poles It is nourished by a rich network of capillaries The membrane contains significant amounts of free or phagocytic hemosiderin Occasionally necrotic osseous lamellae are seen and exceptionally crystals of fatty acids or cholesterol The bottom of the cup and intracystic ridges show irregular foci of osseous necrosis distributed in a delicate connective tissue usually less dense than the intracystic pseudomembrane This is a mummification necrosis different from sequestral necroses seen in most bone lesions Despite disappearance of osteocytes and osteoblasts, the trabecular structure is grossly maintained even to formation of lamellae The osteoid tissue assumes a filamentous cotton-like appearance and tends in places to blend with the surrounding connective tissue The staining properties of sections with this osseous necrosis are retained for a long time The sections usually remain intensely safranophilic, though sometimes they appear basophilic which probably indicates excessive calcium Both characteristics are often seen together This type of osseous necrosis was observed in 23 of the 28 cases These lesions may escape curettage and remain unr[illegible] since they are localized but they were present in [illegible] tissue including the bottom of the cup and intracystic ridges Such necrosis also formed the hard nucleus of free intracystic foreign bodies observed in 2 cases

The author believe that this osseous necrosis is the significant lesion in cysts confined to the long bones i e. the primary pathogenic lesion which precedes or accompanies cyst formation They advance the hypothesis that these cysts

and juvenile desiccating osteochondritis of apophyses and epiphyses are expressions of the same pathologic process ischemic osseous necrosis in the former metaphysiolytic and in the latter epiphysiolytic.

Treatment results were analyzed in 62 patients aged 4 18 with a minimum follow up of 2 years (usually 4-5 years and sometimes 15) Cure after fracture was observed in only 1 patient (with fracture of the humerus) Most patients were operated on shortly after trauma In 4 not operated on the cysts persisted almost 2 years after injury and new fractures occurred. Surgery was performed on 59 cysts and 2 required several operations

Surgical treatment of these osseous cysts poses few problems Some surgeons consider it sufficient to fill the cavity with spongious or cortical bone chips Others simply curet the walls to produce a hematoma which organizes and differentiates into osseous tissue Simple curettage in 9 cases resulted in complete cure in 4 incomplete cure in 1 and failure in 4 Results of curettage and filling with bone in 26 cases were satisfactory in 10 fair in 5 and poor in 11 Healing was better when long rigid grafts were used to fill the cavity but the best results were obtained with a graft larger than the cyst Of 18 patients treated by the latter method 12 had excellent results (Figs 39-42) A technical error was considered responsible for 6 incomplete cures

Optimal treatment should combine trepanation curettage and placement of a long graft extending beyond the upper and lower limits of the cystic area Trepanation should be extensive, with removal of as much pathologic cortex as possible it should be subperiosteal because the healthy periosteum provides new bone of good quality Curettage should be complete. Autogenous bone is preferable for grafting and a tibial graft responds better to mechanical demands than iliac bone. Grafts should be thick and the number required will depend on size of the cavity A cyst at the upper end of the femur poses special problems because of mechanical forces It is preferable to use two types of grafts one in the axis of pressure and the other in the axis of traction Each case must be individualized and the important point is to consider the grafts not only as filling material but as a means of reconstruction of the pathologic segment with a double role mechanical and biologic



Fig. 39 (top left) —La ge metaphysial cy t of end of femur

Fig 40 (top r) —Operation consisted of external trepanation, curettage and placement f long fts extend g beyond cyst. Grafts were placed in direction of lines of force witho t trying t fill cavity

Fig 41 (bottom ft) —X a) bout 5 months after operation showing regeneration f upper end femu Osseou trabecula have same direction as old grafts.

Fig 42 (bottom ight) —X made 15 years after operation.

(Courtesy of Lefranc J nd Nezelof C. Rev chir orthop. 43 385-406, Oct. Dec 1957)

Surgical Treatment of Juvenile Bone Cysts with Spongiosa Plombe is described by H Hellner[4] (Univ of Göttingen) The most important and commonest neoplastic cysts are the juvenile bone cysts Usually they consist of a metaphysial cavity filled with liquid The cavity usually develops from juvenile fibrocytic tissue by liquefaction

A reliable method of treatment is the spongiosa plombe It requires only a small hole in the thinned out cortex. The



Fig. 43 (left) —Juvenile bone cyst in femoral neck.
Fig 44 (right) —Spongiosa plombe after 4 months.
(Courtesy of Hellner H. Chirurg 29-97 103 March, 1958.)

be t source for spongiosa is the patient s iliac bone where it can be extracted without functional or cosmetic impairment The spongiosa plombe is superior to conservative treatment, which is unreliable. To substitute the spongiosa for larger pieces of corticalis or ribs is not advisable Similarly nailing alone is not suggested Even when the bone cyst constitutes transition to giant cell tumors spongiosa plombe is the preferred treatment.

Spongiosa plombe was applied during the last 6 years to all juvenile bone cysts in the humerus femur (Figs 43 and 44) and tibia, without any failures such as lack of stability curtailment of function infection or refracture with necessary reoperation A Rush pin was needed only once

(4) Chirurg 29-97 103 March, 1958.

Radiation Therapy of Solitary Benign Cystic Appearing Lesions Involving Long Bones of Children James C Cook, Kenneth I Krabbenhoft and Robert Songe[5] (Harper Hosp Detroit) gave x ray therapy to 15 children aged 14 months to 19 years who had a solitary benign cystic appearing lesion involving one of the long bones The lesion was in the metaphysis in 9 patients diaphysis in 4 epiphysis in 1 and mandibular angle in 1

The commonest of these lesions are those in the metaphysis adjacent to the epiphysis The earlier the lesion is discovered the nearer it is to the epiphysis and with bone growth it progresses down the shaft and becomes more latent in character There is little symptomatology unless a fracture has occurred X ray films will show an area of central rarefaction with thinning and occasional expansion of the cortex Within the shaft of the long bones of children cystic appearing lesions are less frequent less symptomatic and more easily operated on

In this series roentgen therapy comprised the sole treatment or contributed substantially to a good result. The average tumor dose was 1 182 r given in small fractions over a long period with roentgen rays generated at 200 kv peak potential with 1 5 mm Cu 1 mm Al filtration and half value layer of 0 9 mm Cu at the rate of 13 r/ minute Small fields were used at a target skin distance of 50 cm Treatment was administered in increments of 200 r or less in air through one or two portals at intervals of 1 month or longer The growing metaphysis was carefully protected if possible.

Recently smaller doses have been found sufficient so no more than 1,200 r is suggested as a total tumor dose Usually much less will achieve the desired result Because the success of this treatment depends largely on careful observation, treatment may extend over a year or longer

The exact type of benign cystic appearing lesion is relatively unimportant as all respond in similar manner to proper radiation therapy In those instances in which the desired result is not achieved by small amounts of radiation, successful surgery can be carried out subsequently On the other hand a poor surgical result can be improved by x ray treatment In one instance in this series surgical intervention became necessary after a long period of roentgen therapy

(5) Am. J Roentgenol. 80 505 5 4 September 1958



Fig 45 (left) —Solitary bone cyst 10 months after institution of radiation therapy Initial pathologic fracture had healed and normal bone growth has started to displace cyst toward middle of shaft.
Fig 46 (center) —After administration of total tumor dose of 2,243 r in 18 fractions over 4 ½ years cyst is now in midshaft and not yet filled in. Surgery was done
Fig 47 (right) —Patient has normal use of arm 9 years after institution of radiation therapy and 2½ years after surgery
(Courtesy of Cook, J C, et al Am J Roentgenol. 80 505-524 September 1958)

for a solitary bone cyst of right upper humerus (Figs 45-47) Specimens at the time of the original biopsy and at surgery 6 years later revealed the same type of tissue In the interval the patient was symptom free

With careful application of small doses of radiation the metaphysis can be adequately spared for bone growth to continue normally

Clinical Aspects and Evolution of Histiocytosis Report of Six Cases. Levon K Topouzian Shahan Sarrafian and Edward L Compere[16] (Chicago) advance the theory that histiocytosis is an infectious disease due to a micro-organism In infants and young children the disease becomes quickly acute In adolescents and adults it is more apt to be of the solitary benign or chronic type The type of evolution in the very young groups is assumed to result from lack of

16 Quart. Bull. Northwestern Univ M School 32 106-126, Summer 1958

immunity to the infectious agent which permits easier infestation and progression

The evolution of the disease indicates clearly that eosinophilic granuloma is the basic pathologic lesion and primary complex of histiocytosis Eosinophilic granuloma can recede spontaneously or progress In the latter event the disease can become acute (Letterer Siwe disease) subacute or chronic (Hand Schüller Christian disease) The subacute phase may become chronic and remain as such or recede and resolve itself with treatment Sometimes especially in infants this phase can become acute and have a poor prognosis In the chronic phase subacute exacerbations and disseminations can be seen Regarding the appearance of a bone lesion in an adult which is often attributed to previous trauma it might be that pre existing body resistance and immunity have been disturbed by stress thus allowing a quiescent primary complex to manifest itself

The patient may present secondary infections anorexia fatigue malaise weight loss or failure to gain weight during growth and some fever The skin lesions are of various types and can affect the whole body A positive diagnosis can be made by biopsy Involvement of the lymphatic system is generally a sign of the acute or subacute stage of disease A granulomatous lesion involving the mastoid or petrous bone will often cause otologic complaints The acoustic nerve may be directly or indirectly involved Cerebral cranial or spinal nerve involvement may occur and the presenting symptomatology may simulate any neurologic condition When the destructive process is localized in the orbit it may extend to the sphenoid wing and maxillary sinuses Dental lesions are common and can be the presenting symptom Histiocytosis of the lung is always bilateral and simulates various pulmonary conditions

X ray examination of the skeleton shows recent lesions to be characterized by a well limited punched-out, oval or round intramedullary area of decreased density There is generally a well-defined dense margin and the periosteum, which is not yet involved may be thickened

The ideal treatment is roentgen irradiation

The authors report 6 cases representing different types of lesions The disease was localized in the ilium of an infant, aged 17 months and in the vertebra of a girl aged 7 A

boy 8 had a clavicular lesion which became cystic A man 58 had the monostotic form of lesion with pathologic fracture of the left clavicle A woman 36 presented a monostotic lesion after the disease became polyostotic as well as extraskeletal it finally subsided A woman 37 presented the chronic form of disease with bone and lung lesions and diabetes mellitus

Chondroectodermal Dysplasia (Ellis Van Creveld Syndrome) Report of Two Cases Harris L Smith and Albert M Hand[7] (Memphis Tenn) observed 2 infants with chondroectodermal dysplasia. The four major features of the syndrome (chondrodysplasia ectodermal dysplasia polydactylism and congenital defect of the heart) were present in both The clinical course of each infant was marked by progressive dyspnea and cyanosis leading rapidly to death in the newborn period The cardiac malformation in 1 infant was cor triloculare and in the other was cor biloculare with transposition of the great vessels. The thoracic cage of each infant was extremely narrowed anteriorly and flared infe



Fig. 48.—Section from chondro-osseous junction in left femur of full-term male newborn, Negro showing irregularities in size of lacunae and spicules. (Courtesy of Smith, H. L. and Hand, A M. Pediatrics 21:298-307 February 1958.)

(7) Pediatrics 21 298-307 February 1958.

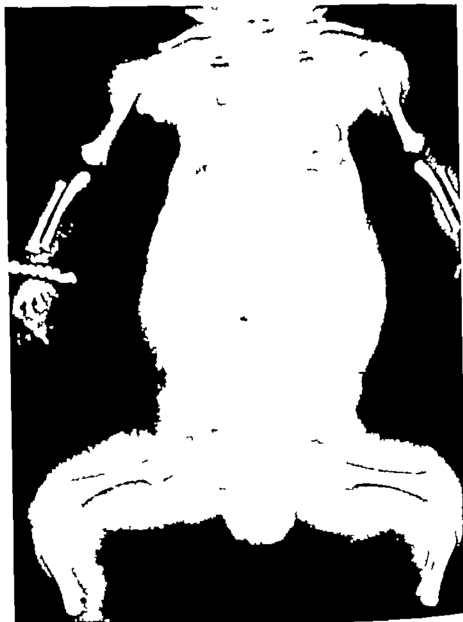


Fig. 49. X-ray of trunk and extremities of male newborn white. Cardiac silhouette almost fills thoracic cage; ribs are horizontal and straightened; humeri are tapered proximally and flared distally; heads of both radii are dislocated and shortening of these bones is proportionately greater than that of ulnae; contours of pelvic bones are irregular. (Courtesy of Smith, H. L. and Hand, A. M. Pediatrics 21:298-307, February 1958.)

riorly Chondro-osseous junctions of the ribs were in the anterior axillary line

Microscopic study of the proximal portion of the left femur revealed a thin chondro-osseous epiphyseal line and irregularly spaced lacunae (Fig 48) The nuclei of the cartilage cells were poorly developed and varied in size and staining quality Cell columns in the zone of proliferating cartilage were shortened and decreased in number There was no zone of provisional calcification In the metaphysis the trabeculae were irregularly disposed and there was evidence of minimal osteoblastic activity Islands of hyaline cartilage were incorporated in the trabeculae of the metaphysis The principal change was a deficiency in the zone of proliferative cartilage that was reduced to 4 or 5 cells in thickness

Death was attributed to the congenital malformation of the heart pulmonary hypoplasia and diminished capacity of the thorax due to chondro-osseous dysplasia

In differential diagnosis the x ray changes are heavily relied on Caffey has stressed the pathognomonic pattern observed in patients with chondroectodermal dysplasia e.g progressively increased shortening from the trunk to the distal phalanges The root bones of the extremities are relatively the longest in contrast to classic achondroplasia in which the reverse is true The proximal ends of the ulnae and the distal ends of the radii are usually large The distal ends of the ulnae and proximal ends of the radii appear too small In one of the earlier case reports and in one of the authors patients the discrepancy in length between radii and ulnae led to compensatory dislocation of the radial heads (Fig 49) In every patient thus far observed there has been a second characteristic feature the widened ends of the tibial shafts appear irregular and the ossification centers in the proximal epiphyseal cartilages are hypoplastic Tendency toward fusion of metacarpals and fusion of capitate and hamate bones is prevalent in these patients Polydactylism in the feet is the exception rather than the rule. Abnormal formations of cartilage may occur and interfere with the function of multiple joints

Report of Six Cases of Chondromyxoid Fibroma of Bone with a review of 30 from the literature is presented by Sennan Iwata and Bradley L Coley[8] (Mem l Center for Cancer

(8) Surg Gynec. & Obst 107 571 576, November 1958.

New York) This tumor is a benign neoplasm apparently derived from cartilage-forming connective tissue. In the 36 cases there was no sex predilection The lower extremity was affected in 32 patients Involvement of the fibula was first seen by the authors (Figs 50 and 51)

The lesion located in the metaphysis and often in adjacent portion of the diaphysis usually gives rise to initial symp-





Fig. 50 (left) —Chondromyxoid fibroma of fibula.

Fig 51 (above) —Gross specimen showing shiny pale glossy homogeneous appearance.

(Courtesy of Iwata, S and Coley B L S rg., Gynec. & Obst. 107 571 576, November 1958.)

toms of pain and swelling though in some instances swelling was noted without associated pain Symptoms evolve slowly and insidiously

The x ray appearance suggests a benign lesion which may be mistaken for central chondroma benign chondroblastoma, bone cyst or even fibrous dysplasia. The microscopic features of the disease may resemble those of benign chondroblastoma

Treatment consisted of curettage in 25 patients resection in 10 and x ray therapy or amputation in 1 each Follow up studies of 32 patients ranging from several months to 18 years revealed recurrence in 4 One of the recurrences was found to be a chondrosarcoma

Fibrous Dysplasia of Bone is discussed by Marvin L. Daves and John H Yardley[9] (Johns Hopkins Univ) Fibrous dysplasia denotes a group of diseases comprising Al

(9) Am. J M. Sc 34 590 604 November 1957

bright s syndrome polyostotic fibrous dysplasia and monostotic fibrous dysplasia (including craniofacial fibrous dysplasia) The cause of fibrous dysplasia is unknown

Albright s syndrome is characterized by multiple skeletal lesions containing fibrous tissue associated with metaplastic bone formation areas of cutaneous pigmentation and sexual or skeletal precocity In polyostotic fibrous dysplasia the same multiple bony lesions are seen with signifiant extra skeletal manifestations Cafe au lait spots may or may not be present

In the involved skeletal areas the lesions tend to oblit erate the medullary canal and thin the overlying cortex. If by x rays a homogeneous ground-glass medullary opacification is observed which blends imperceptibly with cortical bone and has no sharp margins the diagnosis of fibrous dysplasia can be made with confidence Sometimes the cortex may be thinned thickened or shaped like a candle flame. The medullary canal may show a single or multiloculated cystic appearance or a smudge resembling columns or smoke curling upward. Superimposed on and perhaps responsible for some of these lesions may be innumerable deformities caused by repeated fracture Thus variations in the x ray findings are great

The distribution of the osseous lesions is extremely variable and erratic In a given patient unilateral lesions may be the most striking feature The ribs are usually involved and occasionally undergo a tremendous expansion not seen in other bones An equally dramatic finding is collapse of the rib cage on one side producing chest x rays suggestive of an extensive thoracoplasty with regeneration of the resected ribs The vertebrae are usually spared but may show cystic changes Involvement of the pelvis is almost always cystic

Craniofacial and monostotic fibrous dysplasia include those isolated bony lesions that are identical roentgenographically and pathologically with the lesions seen in polyostotic fibrous dysplasia. Since fibrous osteoma and ossifying fibroma are identical with the lesions seen in polyostotic disease they are examples of fibrous dysplasia.

Because of one or more points of dissimilarity to fibrous dysplasia nonossifying fibroma benign cortical defects and osteoma should be considered distinct from fibrous dysplasia. The name cherubism should be used to avoid the con

tusion caused by calling this lesion which is apparently distinct from fibrous dysplasia familial fibrous dysplasia of the jaws

Four Cases of Myelomatosis K W McNabb[1] observed 4 patients with varied x ray manifestations of myelomatosis The site and type of lesion were different in each patient and pain was the only common factor

CASE 1—Woman 64 had enlargement of the medial end of the clavicle. X rays showed cystic expansion of the medial end of the clavicle with irregular coarse trabeculations within it. A healing frac



Fig 52.—M ltiple defects i kull. (Courtesy of McNabb, R. W J Fac. Radiologists 9 13-15 January 1958)

ture was present at the junction with normal bone. Lateral x ray views of the skull (Fig 52) revealed multiple areas of rarefaction in the vault of the skull and mandible. Survey of the skeleton showed one small area in the shaft of the left humerus On biopsy of the clavicle a cyst was found containing extremely vascular plum-colored material resembling blood clot. Histologic study showed neoplastic plasma cells of myelomatosis

CASE 2.—Man 62 was hospitalized because of back pain X rays showed collapse of the 7th dorsal vertebra Autopsy revealed collapse of the 7th and 9th dorsal vertebrae which were infiltrated with nodules of white growth Enlarged glands were present in the lower mediastinum infiltrated with growth. Histologically the growth showed cells of plasma cell m eloma.

CASE 3—Man 63, o prolonged history of pain in the left hip X rays of the hip sh n area of cortical destruction and rarefaction medial to the cetabulum. Sternal marrow and serum electrophoretic studies i ated myelomatosis

(1) J F c. Radiologists January 1958

CASE 4—Man 73 had increasing chest pain. X rays revealed absence of bone in some ribs and a rather mottled pattern in other ribs The urine contained Bence Jones protein with an electrophoretic mobility of gamma globulin.

Considerations in Surgical Management of Atypical Musculoskeletal Malignant Tumors According to Albert J Schein the usual treatment of musculoskeletal malignant tumors of the extremities is proximal amputation when feasible Exceptions to this method are unusually radiosensitive tumors likely to be multicentric (such as Ewing s tumor or reticulum cell sarcoma) and atypical tumors such as osteogenic sarcoma mesenchymoma fibrosarcoma and fibrosarcoma engrafted on pre-existing fibrous dysplasia In selected patients with these atypical tumors local radical resection may be done instead of amputation

Factors in the selection include size of the tumor and degree of localization so that it is contained within a particular bone or muscle resectability without sacrifice of vital structures which would render the limb useless or devitalized encapsulation or regional localization so that excision is possible in toto without entrance into the mass but inclusive of the biopsy site and degree of malignancy as indicated by biopsy and clinical invasiveness If the opinions of competent pathologists differ as to the presence or degree of malignancy local resection may be considered High grade malignancies may also be considered for such therapy if proximal in the limb so that the difference in certainty of excision is not great as between amputation and resection each case to be judged individually Large tumors of weight bearing bones involving complicated grafting replacement prolonged convalescence and consolidation time for useful function should not be treated this way except if otherwise favorable from all other standpoints Perforation of such malignant tumors through the cortex especially of a long bone, indicating aggressiveness in the growth renders local recurrence extremely likely despite the existence of a report of low grade malignancy on biopsy In such instances therapy by amputation rather than by local resection is preferable

Myeloplastic Sarcomas are discussed by O Scaglietti[3] (Univ of Florence) with special reference to treatment in

(2) J Mt. Sinai Hosp. New York 25 498-518, Nov Dec., 1958
(3) Gazz sanita 28 604-613 Nov Dec., 195

dications based on clinical radiographic and histopathologic data in 27 cases with careful follow up

Among giant cell tumors of the skeleton is a group designated as giant cell sarcoma which on clinical radiographic and histologic study exhibits local malignancy These tumors develop rapidly, are very destructive and have a high rate of recurrence They are quite different in radiologic and histologic pattern from typical giant cell tumors but have some points of similarity with osteogenic-osteolytic sarcomas Accurate differential diagnosis is important as regards therapeutic considerations

Giant cell sarcoma diagnosed relatively early can be cured by radical resection but will recur if treated by x rays or limited resection All recurrences show various degrees of change and often have a capacity for malignant metaplasia with generalized progression and death from metastases

Complete removal of the tumor may be effected by resection with or without bone grafting and amputation with disarticulation Resection is sufficient in certain sites such as the clavicle or fibula in proximal metaplasia of the radius and in the phalanges and ribs it is also effective in myeloplasia of the superior metaepiphyses of the humerus Involvement of the entire metaepiphysis requires bone grafting at the same operation or later to restore skeletal continuity This procedure is used in treatment of giant cell sarcoma of the distal and proximal metaphyses of the tibia and femur the distal metaphysis of the radius humerus and metacarpals and the proximal metaphysis of the ulna Previously operated on and irradiated recurrent tumors can be further treated in this manner only if there is no clinical and radiologic evidence of malignant degeneration Amputation is indicated in advanced lesions with involvement of soft tissue in the aged in previously operated on recurrent tumors with evidence of malignancy and in tumors previously treated by x rays if there is no evidence of generalized metastases

Late results in the author s series confirm the validity of these indications In 14 of 27 cases resections were performed in 4 bone grafting was not done because of localization of the lesion with complete cure for 2 15 years Of 10 patients treated by bone grafting with resection cure was complete and lasting in 9 (follow up 4-20 years) One patient

died a few days after operation Of 8 patients on whom amputation was done, 1 died of metastases a few months after operation and the others are well 2 30 years after surgery

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ARTHRITIS AND RHEUMATISM

Agglutination Tests in Diagnosis of Rheumatic Diseases B S Rose and D Whillans[4] (Auckland Hosp) point out that there is still no single simple test for rheumatoid arthritis which is applicable under all circumstances However, sensitized sheep cell agglutination tests may be decisive in the definite diagnosis of rheumatoid arthritis in particular patients if considered along with other diagnostic criteria. The authors use the Rose tests

METHOD —The serum is first absorbed with packed washed sheep cells and dialyzed for 2 days against a weak citrate phosphate buffer of pH 6. The precipitated euglobulin is collected washed and redissolved in saline, and both the absorbed serum and euglobulin fraction are tested for agglutinating properties against sheep cells which have been sensitized with hemolysin. The amount of hemolysin used is half that amount which will cause the sheep cells to agglutinate by themselves, and the final dilution of sheep cells is 0.25% The hemolysin is prepared by the method of Sawyer and Bourke. The euglobulin is tested for agglutination inhibition of a known positive serum. In this test the washed cells are sensitized with about 1/20 of the agglutinating dose of hemolysin.

All dilutions of serum and euglobulin commence at 1 16 and are carried out in doubling dilutions to a titer of 1 32,768 in the case of the serum and euglobulin and to 1 512 in the case of the inhibition titer These are the final dilutions of serum and euglobulin in each tube.

The tests are read after holding for 16 hours at 4 C. The readings are performed by observation of the button in the bottom of each test tube by means of a concave mirror

The following titers in conjunction with other evidence are provisionally accepted as being significant in the diagnosis of rheumatoid arthritis (1) serum titer of 1 64 or over (2) euglobulin titer of 1 32 or over and (3) inhibition titer of 1 16 to 1 32 or under A negative result does not exclude rheumatoid arthritis and false positive results can occur in other conditions including systemic lupus erythematosus and hepatitis

When the sensitivity of the tests is so arranged that only

(4) New Zealand M J 46.525-531 October 1957

about 75% of rheumatoid arthritic patients yield positive results; the results in ankylosing spondylitis are almost invariably negative even with peripheral joint involvement. In juvenile rheumatoid arthritis and psoriatic arthritis only about 20% are positive. Modifications so far have not significantly altered these findings but have helped in exclusion of false positive reactions in hepatitis and systemic lupus erythematosus.

The test is useful in clinical research as one of the diagnostic criteria which can be used in the selection of samples for comparison in population surveys and clinical trials. More rapid modifications of the agglutination tests are now being devised in which gamma globulin precipitation is used to avoid the delay involved with dialysis.

Bentonite Flocculation Test for Rheumatoid Arthritis is described by John Bozicevich, Joseph J. Bunim, Jules Freund and Stanley B. Ward[5] (Nat'l Inst. of Health). All serologic tests for rheumatoid arthritis depend on clumping of particulate matter by addition of serum from patients. Some tests use sheep cells; the red blood cells are mixed with a subagglutinating amount of immune rabbit serum or with human gamma globulin. The authors used bentonite particles coated with human gamma globulin.

The bentonite flocculation test is simple and can be done in 20 minutes once the stock solutions are prepared. Bentonite, a colloidal clay of powder consistency, is stable and readily available. It consists of abundant negatively charged particles whose surface/mass ratio is unusually large. After the particles are sensitized with normal human serum gamma globulin (fraction II), they clump when mixed with serum from patients with rheumatoid arthritis. The serums to be tested are not absorbed or fractionated.

Of 82 adults with verified cases of rheumatoid arthritis the bentonite flocculation test was positive in 85.5%. Of 227 controls the test was negative in 97.4%.

Evaluation of Bentonite Flocculation Test in Rheumatoid Arthritis was undertaken by H. Rowland Pearsall, Henry Tesluk, David W. Anderson, C. L. Williams and Dorothy Beggs[6] (Seattle). It has been established that the serums of patients with rheumatoid arthritis contain a factor which

(5) Proc. Soc. Exper. Biol. & Med. 97:180-183, January, 1958.
(6) Northwest Med. 57:615-619, May, 1958.

in a high percentage agglutinates sensitized particles such as bacteria, erythrocytes, collodion, latex and other substances. The serum rheumatoid activity (rheumatoid factor) resides in the globulin fraction and is not associated with the albumin proteins. This rheumatoid factor is a large gamma globulin molecule with an ultracentrifuge sedimentation characteristic of 19 S. A second substance is also encountered in the gamma globulin fractions of most normal persons which interacts with the rheumatoid factor and can be used in specific tests for it.

The various methods for establishing the presence of the rheumatoid factor include agglutination of sensitized antibody-coated cells or particulate bodies, precipitation reaction with gamma globulin and inhibition of agglutination by gamma globulins from certain normal serums. The exact antibody antigen characterization of these reactions is obscure.

Bozicevich and Bunim have described a simple rapid method using bentonite particles sensitized with fraction II that can be completed in 20-30 minutes. The authors evaluated results of the bentonite flocculation test in 180 patients with rheumatic complaints. They also compared the simultaneous determinations (on frozen serum) of the sheep cell agglutination test as modified by Ziff and the bentonite flocculation test on frozen serums of 118 patients. The bentonite flocculation test was as reliable as the modified sheep cell agglutination test. It was positive in 77% of the patients with definite rheumatoid arthritis and helpful in diagnosis of 1 of 3 patients with probable or possible rheumatoid arthritis. Positive reactions are more likely to occur in the advanced disease but have been reported at onset of the disease. The degree of agglutination is not necessarily related to the severity or activity of the disease as determined clinically.

The test was uniformly negative in rheumatic diseases other than rheumatoid arthritis. It is considerably less time consuming than the sheep cell agglutination test and can be done as a routine test in rheumatic diseases.

Experimental Investigations into Hemagglutinating Factor in Blood and Joint Fluid in Rheumatoid Arthritis are reported by Nanna Svartz[7] (Karolinska Hosp., Stockholm). Hemagglutination of pretreated red cells can be produced

(7) Ann. Rheumat. Dis. 16:441-447, December 1957.

by serum from different diseases The hemagglutinating substances are not identical e.g., that in lupus erythematosus differs from that in rheumatoid arthritis The hemagglutination factor is precipitable in cold in rheumatoid arthritis but not (or rarely) in other diseases such as disseminated lupus erythematosus and slceroderma

Attempts were made to isolate the cold precipitable factor in rheumatoid arthritis by zone electrophoresis ultracentrifugation and chromatography with carboxymethyl cellulose Zone electrophoresis of cold precipitate yielded 20-25 protein fractions The rheumatoid factor was present mainly in the gamma globulin area Ultracentrifugation of cold precipitate from rheumatoid arthritis serum demonstrated that the rheumatoid factor was associated with a macroglobulin fraction showing a sedimentation constant of 19 25 Svedberg units The fractions containing low molecular globulins did not evoke hemagglutination.

Evaluation of Hemagglutination Tests in Diagnosis of Rheumatoid Arthritis I S S C., F II S C and F III L.P Systems *Harry Bartfeld Elizabeth Mahood and Edward F Hartung*[8] (New York Univ) performed these hemagglutination tests for rheumatoid arthritis on 239 patients with all diagnoses (1) Heller I modification of the Rose test formerly designated as the SEA or SCA test, now as the S S C test (2) fraction II or gamma globulin modification of Heller Jacobson Kolodny and Kammerer now referred to as the F II S C test and (3) latex fixation or F II L.P test. The performance of these tests concurrently showed agreement in 83% Correlation was higher between the S S C and F II L P tests

In patients with classic or definite rheumatoid arthritis all three tests were positive in 62 8% The S S C test was positive in 66.3% the F II L P in 68.2% and the F II S C in 72.2 % In probable and possible rheumatoid arthritis the three tests consistently gave more positive tests than in the controls In the control series (nonrheumatoid and noncollagen disease) the S S C test was positive in 8 6% the F II L P in 4 3% and the F II S C in 15.2%

The higher incidence of F II S C positives in all series is due in part to use of titer of 1 56 or higher as the positive standard This value should be changed and the positive

(8) Ann. Rheumat D 17 83-88 March, 1958.

titer standardized at 1 896 and higher Analysis of concurrent S S C and F II S C. tests of 263 rheumatoid serums showed that more than one rheumatoid factor may be present in rheumatoid serums Factors inhibiting the activity of the rheumatoid factors are also recognized as important

All three tests (with allowances for proper standards of positive titers) are equal in sensitivity for routine diagnostic screening The F II L P test is preferred because of its simplicity and rapidity, but the lowest titer recognized as positive should be 1 160

Trial of Latex Fixation Test for Rheumatoid Arthritis Robert M Pike, S Edward Sulkin Howard C Coggeshall and Mary Louise Schulze[9] (Southwestern Med. School) performed the latex fixation test on specimens of serum from 311 persons The procedures described by Singer and Plotz were followed with only minor modifications Of 165 patients with the clinical diagnosis of rheumatoid arthritis 69.7% had a positive test These patients exhibited symptoms of varying duration. Some of them were receiving therapy Occasional positive tests were obtained on the serum of patients believed to have osteoarthritis fibrositis or bursitis, whereas no positive tests were recorded for other persons Of the 6 positive reactions obtained on the serum of patients other than those with rheumatoid arthritis only 2 were strong (3+) the other 4 were minimal

Second specimens were obtained from 52 patients 2-8 months after the first specimens. There was complete agreement in 44 The first specimen of 8 patients was positive and the second negative 6 of the first specimens gave weak reactions (1+) although 2 were slightly stronger (2+) In no instance did the serum of a patient with a negative reaction become positive during the observation period.

The authors results are in general agreement with those reported by others

Course and Prognosis in Rheumatoid Arthritis J J R Duthie, P E. Brown J D E Knox and M Thompson[1] (Northern Gen'l Hosp Edinburgh) report follow up data on 247 patients with rheumatoid arthritis who were hospitalized during 1948-51 At the last examination some 6 years after discharge from the hospital 24% of patients could carry

(9) Am. J Clin. Path. 30 28-31 July, 1958.
(1) Ann. Rheumat. Dis. 16 411-434 December 1957

on all normal activities 40% were moderately incapacitated, 26% were more severely crippled and only 10% had become helpless and dependent on others There was remarkably little change in the distribution of patients over the four grades of functional capacity between the first assessment made 2 years after discharge and the last assessment nearly 4 years later The disease was moderately active throughout the period of study in about 65% of patients but the proportion rated as having very active disease had decreased At last assessment nearly 30% showed no signs of activity Of patients considered eligible for remunerative employment on discharge from hospital 39% were engaged in normal work and 38% in suitable light work at the last assessment All, or all but the heaviest tasks in the home could be done by 60% of the housewives

Various factors with a possible bearing on prognosis were considered The most important proved to be duration of the disease and its course before hospitalization sex response to conservative treatment in the hospital as measured by *changes in functional capacity and disease activity between* hospitalization and discharge and the results of the sensitized sheep cell test Age at onset disease activity functional capacity erythrocyte sedimentation rate and hemoglobin level on admission were of little or no value in predicting the subsequent course of the disease.

Rheumatoid Arthritis of the Feet. In discussing types of arthritis commonly seen in the feet, L M Lockie and Harold M Robins[2] (Buffalo) state that osteoarthritis first may involve the metatarsal joint of a great toe This eventually becomes the so-called hallux rigidus There is no swelling or discoloration except after prolonged standing or walking Osteoarthritis may also occur in other joints of the feet but is mild.

Rheumatoid arthritis of the feet involves the ankle metatarsal phalangeal joints and phalangeal joints The ankle is swollen and capable of little motion The patient walks in a guarded manner If there is discoloration the joint is somewhat red and warm The metatarsophalangeal joints are swollen warm and tender This involvement of the feet is usually diffuse

Treatment of rheumatoid arthritis is started with com

(2) J M Soc New Jersey 55 656-661 December 1958

plete bed rest in a hospital for 3 weeks The feet are kept in the optimum position i e at right angles to the legs by a footrest or footboard at the end of the bed which is well padded and will keep the covers from pressing on the feet.

Radiant heat in dry or moist form is applied at least once daily In going through full range of motion the patient performs set exercises such as inversion and eversion of the ankle rolling motion of the forefoot and flexion of the toes Passive exercises are forbidden in acute arthritides of the feet When acute inflammation and pain subside the patient may get up

If deformities are present a properly constructed support should be used. This should be of soft cork or sponge rubber at first and no attempt at correction should be made. The patient must continue to receive physical therapy Massage is never used to the painful, swollen joint.

Aspirin and sodium salicylate, 10 gr are given 4 times a day Patients in whom salicylates fail may be helped by phenylbutazone 100-300 mg/day

Gold therapy is at present the most effective method for stopping progression of arthritis Injection of not more than 1 dose a week of Myochrysine* intramuscularly is recommended The dosage schedule is 10 mg the 1st week 20 mg the 2d week, 30 mg the 3d week and 40 mg the 4th week. The last dose is repeated at weekly intervals until a total of 500-750 mg has been given Patients eventually will be given about 10-20 mg at monthly intervals for an indefinite period if no toxic reaction has occurred When the arthritis becomes inactive chrysotherapy is discontinued

Steroid therapy is indicated when the clinical status is discouraging despite adherence to a carefully planned program in short term exacerbations in patients with severe constitutional symptoms and during rehabilitation of the patient with severe involvement

Prednisolone in Management of Rheumatoid Arthritis Darrell C Crain and James A Kehoe[3] (Georgetown Univ) used prednisolone plus other measures for periods up to 1 year in the management of 87 patients with rheumatoid arthritis It provided satisfactory control in 79% of the patients and was considered superior to prednisone in most of 19 patients in whom comparison was possible

(3) M Ann. District of Columbia 27 73-76, Februar

Dosage requirements varied widely among patients There was no one optimum dosage of prednisolone for all or even *for most patients although a slight majority was maintained* on 7 5 10 mg prednisolone daily in divided doses In 5 patients all of whom responded well to therapy dosage could be reduced over 2-6 months to zero indicating complete remission of the rheumatoid arthritis

The optimal dosage of prednisolone was mainly determined not by its therapeutic effect but by the incidence and severity of side effects With increasing dosage of prednisolone the frequency of side effects increased from 10% at a level of 5 mg daily to 22% at 7 5 10 mg and 67% at higher levels For the entire group, the incidence of side effects was *32% It was usually possible to maintain* prednisolone dosage unchanged despite moderate facial mooning the commonest side effect Other side effects were abdominal bloating (7 patients) edema (5) and weight gain (3) Occasional reactions included excessive loss of hair dryness of skin petechiae hirsutism excessive sweating constipation local deposit of fat and muscle weakness Reactions were severe enough to require complete withdrawal of prednisolone in 4 patients in whom severe gastrointestinal symptoms developed Vertebral damage due to progressive osteoporosis was detected radiologically in only 1 of 23 patients who received prednisolone for several months

Surgery of Rheumatoid Arthritis is evaluated by Lewis Cozen[4] (Los Angeles) Successful arthroplasty has been performed in almost all stages of rheumatoid arthritis of the hip joint When done early in the disease, good strong musculature helps to move the joint postoperatively When done late there is greater need for good musculature usually because of involvement of more joints of the lower extremity Arthroplasty is generally indicated only when both hip joints are affected There should not be too much involvement of the upper extremities because the patient must be able to use crutches postoperatively perhaps permanently Involvement of the knee joints does not contraindicate the operation as long as there is no severe flexion contracture of the knee In cup arthroplasty the anterior approach allows easier division of the contracted capsule and muscles especially the psoas

(4) Rheumatism 14.2 11 January 1958.

The Girdlestone operation or excision of the hip joint has a definite place in rheumatoid arthritis It consists of com plete removal of the head and neck of the femur The acetab ular edge may be removed to gain more relaxation of the soft tissues but this does not seem necessary Indications for the Girdlestone operation are much the same as for cup arthroplasty except that it should be done when the disease is in a more active phase and possibly in older patients more as a salvage procedure than the more conservative cup arthro plasty A therapeutic pool is of inestimable value in postoperative care of the rheumatoid hip

Osteotomy of the femur has a rightful though infrequent, place in rheumatoid arthritis of the hip If the hip is anky losed completely or partially in a nonfunctional position of flexion and adduction and if return of motion in the hip joint is not particularly needed, then osteotomy cutting the femur in the region between the trochanters is indicated The operation can be done simply by lateral approach just below the greater trochanter A chevron (∨) osteotomy is done, the deformity is corrected and a plaster spica is applied. Ordi narily plaster should be used instead of one of the blade plates because the bone is osteoporotic and the plate and screws are apt to cut through the bone. Union of the osteot omy site proceeds rapidly in rheumatoid arthritis and the plaster may usually be discarded after 10 weeks if there is sufficient x ray evidence of consolidation

In flexion contracture of the knee, if the soft tissues on the posterior aspect of the knee are not too rigid traction should be tried. If it fails manipulation under general anesthesia should be the next step Manipulations should be repeated every 2 3 days until no further improvement in extension is obtained. Corrective bivalved casts may be tried in some patients in whom the deformity is not extremely rigid For severe flexion contracture of the knee the method of Badgley is excellent. Synovectomy has been satisfactory for suitable cases of knee joint involvement. The author performed it as a primary operation in a patient with a persistently swollen knee but no other joint involvement.

The ankle joint and shoulder do not readily lend them selves to surgery when involved with rheumatoid arthritis Rarely when there is a fixed severe equinus or contracture of the foot corrective osteotomy is necessary If deformity

of the toes is mild it can be treated satisfactorily by corrective appliances Metatarsal bars on the undersurface of the sole of the shoe help to allay the pain of claw toes

Arthroplasty of the elbow is done by excising the articular surfaces and ¼ in of the bone on each side of the articular surface The excision is made to conform roughly to the shape of the original elbow joint. The joint surfaces are covered with fascia lata taken from the patient s thigh The edges of the fascia are tucked in and sewn to the soft tissues adjacent to the elbow so that a securely attached double layer of fascia results across the new joint surfaces In finger joint deformity interphalangeal or metacarpophalangeal with moderate motion in the joint capsulorrhaphy tightening the capsule should be considered to correct the deformity

Surgery of the spine is indicated in flexion deformity that is so severe that the patient cannot see ahead of him despite forced extension of the hips In rheumatoid spondylitis the hip joints are often involved as well as the spine so that the flexion deformity can be severe indeed These conservation measures to correct the deformity should be tried first head traction by use of a head halter combined with leg traction on a hard frame (this can be surprisingly effective at times) and intermittent exercises to prevent recurrence of the flexion deformity If the deformity is not amenable to these conservative measures osteotomy of the spine should be considered

Arthritis and Automobile Accidents Jacob Kulowski[5] (St Joseph, Mo) reviewed records of 250 patients who had residual disabilities of the neck and back. Distribution of the lesions was the neck 100 patients the back 100 and the neck and back 50 The most important factors in the development of residual crash spinal disabilities are the biomechanical implications with regard to vehicular seating

There are three phases to vehicular seating The first implies going to getting in sitting getting out and going away from a vehicle The second involves changes from standing to sitting with the car at the curb This calls for variable anterior rotation of the pelvis and flattening of the lumbar vertebrae besides major flexion at the hips and knees. The lowered center of gravity is somewhat offset by the forward shift of the line of gravity which together with the

(5) Rheumatism 14 28 J April, 1958

tendency of most persons to slump increases the stress at the lumbosacral level At the same time this situation favors more eccentrically placed loads on the anterior margins of the vertebrae when crash conditions impose increased vertical loads These may lead to compression fractures of the vertebral bodies Third with the car under way vibratory and grosser oscillations transmitted to the rider by the seat underscore the fundamental instability of the rider The consequences of inertia (in the unrestrained rider) under crash conditions are most strikingly demonstrated in the extraordinary instability of the body mass and masses Under normal conditions the needs of driving and changes in speed and direction result in repetitious loss and gain of the seated body equilibrium These changes may call for considerable neuromuscular co-ordination and strength

About three fourths of the study patients had arthritis at the time of their accident which was minimal in one third moderate in one-third and advanced in one-third The cervical spine was involved in about 60% of the patients one third of whom were drivers. Analysis showed that drivers with cervical arthritis had more rear-end and angular collisions than the others Most of these accidents happened at intersections and other points where increased peripheral visual activity is mandatory Because restrictions of cervical movement that cannot be compensated by vertebral segments below may limit peripheral visual activity a causal relation to greater than average incidence of rear end and angular collisions among arthritic drivers may be inferred

The fundamental relations between human deficiencies and clinical results of crash forces—with regard to spinal arthritis—may be derived from the concept that the spine functions as a curved spring Anything that interferes with this intrinsic flexibility of the vertebral segments may be considered a stress raiser or point of weakness Because a chain is only as strong as its weakest link it can be accepted that arthritis of the spine may increase its vulnerability to crash forces

About 60% of the study patients required some disability rating About one half of these were radiologically negative Major pitfalls to evaluation from this standpoint were presented by arthritis and disk pathology Issues were often raised with regard to aggravation of a pre-existing condi-

tion if such were the case and posttraumatic arthritic and disk pathology sequelae Of those who presented these findings at their initial orthopedic examination arthritis and disk pathology had been estimated to have been present at the time of the accident in about 25% It was postulated that in the others the accidents may have had causal relationships in a clinical sense.

Bone and Joint Changes in Hemophiliacs Gabriel Stiris[6] (Rikshosp, Oslo) studied these changes in 35 hemophiliacs In most the initial hemorrhage into a joint followed trauma.



Fig 53 —Typical changes in hemophilic joint deformed condyles with irregular rticular contours, pseudo-osteophytes and cysts, and increased density of soft tissues. (Courtesy of Stiris, G.: Acta radiol. 49 269-275 April, 1958.)

The hemorrhages subsequently recurred with the slightest sprain or twist and were accompanied by swelling and intense pain The knee joint was the most commonly affected

The most characteristic findings were erosion and cyst formation The erosion generally occurred juxta articularly and the articular margin appeared as a protrusion a pseudodeposit. This occurred most often in the knee and elbow joints and less often in other joints The erosion was sometimes marked with some shrinkage in the articular cartilages The natural depressions in the joints such as the intercondyloid fossa in the knee joint and the semilunar incisura in the elbow joint were widened and deepened (Fig

(6) Acta radiol. 49 269 275 April, 1958

53) Cyst formation occurred in most of the joints The cysts varied in size and were mainly situated in the epiphysial area although they also occurred in the metaphysis and diaphysis

Deformity was most often found in the knee and elbow joints and less often in the ankle joint and other joints The articular outlines were irregular with diminished articular space. Bony ankylosis was shown only once. Contractures were common Hypertrophic joint capsules and increased density corresponding to the recesses were often observed. The increased density was assumed to have been caused by hemosiderin in the tissues In some joints arthrotic changes were also observed in the regressive stage.

Experimental Arthritis III. Modification of Acute Lesions in Guinea Pig by Corticotropin (ACTH) and Steroids. Russell S Jones and Yolande C. Mayne[7] (Univ of Utah) observed that the acute arthritic lesions induced in the guinea pig by a simple intravenous injection of a polysaccharide complex from Klebsiella pneumoniae were modified by corticotropin and certain steroids Corticotropin and cortisone initially decreased, then increased the basophilic material having the histochemical characteristics of hyaluronic acid The eosinophilic PAS-reactive material apparently a complex of hyaluronic acid and protein was not decreased by these hormones Corticosterone initially increased but later decreased the amount of hyaluronic acid and the eosinophilic PAS-reactive substance. Progesterone, pregnenolone 11-desoxy 17 hydroxycorticosterone and vehicle controls did not significantly modify the joint change but corticosterone (compound B) a steroid relatively foreign to the guinea pig led to toxic responses to the nonlethal nontoxic, haptenic bacterial polysaccharide

The fibroblast and synovial cell are thought to be cellular elaborators of hyaluronic acid. Cortisone could modify the function of these cells The biologic effects of cortisone hydrocortisone and other steroids on connective tissue vary considerably with the animal species Wound healing in which fibroblasts play an important role, is suppressed by small amounts of cortisone in man and the rabbit, whereas 50 mg/kg is required to suppress wound healing in the guinea pig and the rat

(7) A.M.A. Arch. Path. 65:247 260 March, 1958.

In guinea pigs cortisone 30 mg/kg daily decreased over all synovial cell proliferation but not the number of small areas of polypoid proliferation due to intravenously injected bacterial polysaccharide. This effect on synovial cells was accompanied by initial decrease and later increase in the presumed product of these cells hyaluronic acid. Corticosterone did not reduce the over all synovial proliferation but lessened the quantity of hyaluronic acid at 7 days The eventual explanation for such effects may be found in the rates of synthesis cellular release polymerization and resorption of hyaluronic acid complexes

In treatment of rheumatoid arthritis and related disease processes cortisone and hydrocortisone are effective when given systemically and hydrocortisone is effective when given intra articularly After intra articular injection of the steroid the reduced viscosity and hyaluronic acid concentration of arthritic synovial fluid tends to increase toward normal values Total protein concentration of synovial fluid shows no consistent change but sodium ion concentration decreases toward normal Platt and co-workers found that although the clinical state is improved by such therapy the synovial fluid does not return fully to normal supporting the concept that the disease process has been suppressed but not cured

There may be a parallel between the steroid treated joint disease in man and in the guinea pig corticotropin and cortisone increase the relative amount of hyaluronic acid without decreasing the protein material This may be a significant clue in explaining the clinical improvement in man

Evaluation of Uricosuric Agents in Chronic Gout was carried out by M A Ogryzlo and Joan Harrison[8] (Toronto) The agents evaluated were probenecid (Benemid®) phenylbutazone (Butazolidin®) thiophenylpyrazolidine (G 25671) sulfoxyphenylpyrazolidine (G-28315) acetylsalicylic acid (aspirin) and ethyl biscoumacetate (Tromexan®) Improvement in clinical symptoms and manifestations of chronic gout was observed with all agents that showed uricosuric action Salicylates in doses necessary for good uricosuric action were not tolerated for more than 3 months In general probenecid was well tolerated by those in whom a good uricosuric effect was obtained with doses of 1 1 5 Gm daily

(8) Ann Rheumat Dis 16 425 437 December 1957

In most of these, colchicine was administered concurrently in suppressive doses of 1 1.5 mg daily Chronic symptoms of stiffness and aching in various joints though somewhat subdued persisted in many patients and sporadic attacks of acute gouty arthritis continued though the attacks were less severe and less frequent than before start of treatment When doses of 2 3 Gm daily were necessary for a good uricosuric effect toxic manifestations were more common consisting mainly of gastric irritation dermatitis or urticaria

The newer drugs G 25671 and G 28315 which are derivatives of phenylbutazone were given patients who had not previously been treated with uricosuric agents or in whom therapy with probenecid was unsatisfactory G 25671 was given to 25 patients in 33 separate therapeutic trials for periods up to 12 months The drug was well tolerated by all with no indication of gastric irritation Mild maculopapular rash appeared in 3 patients during the first 6 weeks of therapy but subsided after 2 3 days with use of Pyribenzamine* and did not recur despite continuation of G 25671 No other toxic manifestations were noted although the white cell count was depressed slightly in several patients Invariably the uricosuric response was greater than that to probenecid in the ratio of 3 1 per unit of weight. One patient who previously had aggravation of acute attacks with probenecid also had four attacks of severe acute gouty arthritis during the first 6 weeks of G 25671 even with addition of 1.2 mg colchicine daily and 5 others had from 1 to 3 mild attacks during the 1st month of treatment For this reason suppressive doses of colchicine were used at start of treatment especially in patients prone to frequent attacks of acute gouty arthritis Acute attacks were completely suppressed in all the other patients after therapy with G 25671 was begun All noted progressive improvement in chronic stiffness and pain increased strength energy and general sense of well being to a degree not previously observed with probenecid In general the greatest improvement was noted in patients in whom the serum uric acid was maintained well below the upper range of normal

The clinical improvement and uricosuric action observed with 0 5 Gm daily of the newer analogue G 28315 were comparable to that obtained with 1 Gm daily of G 25671 No toxic effects were seen

Lipogranulomatosis New Lipoglycoprotein Storage Disease was observed by Sidney Farber Jonathan Cohen and L Lahut Uzman[9] (Boston) in 3 patients The syndrome presented a fairly uniform clinical picture. Onset, soon after birth was characterized by sensitivity and swelling of the extremities accompanied by a hoarse weak cry Progress of the disease was marked by chronic progressive severe and generalized involvement of joints appearance of nodules in the subcutaneous and periarticular tissues (Fig 54) increasing dysphonia because of fixation of the laryngeal cartilage and finally dyspnea when pulmonary infiltration supervened Febrile and afebrile periods alternated during the first stages of the disease The lymph nodes were slightly enlarged The spleen and liver were of normal size

The extremities and larynx first showed characteristic lesions but systemic symptoms of irritability febrile episodes and poor weight gain also were evident from onset. At that stage the diffuse swelling and hyperesthesia of the extremities called attention to the skin lesions and concealed those of the joints As the skin swelling subsided the articular involvement became obvious and then it was recognized that the hoarseness was due to joint involvement in the larynx. The problem became one of differential diagnosis of a generalized disease involving lesions of skin and joints and throughout the disease until signs of visceral involvement overshadowed them these lesions remained outstanding

The skin lesions which at first consisted of generalized swelling of the skin of the extremities soon changed into nodular thickenings near most joints and tendon sheaths and on the chest abdomen and occiput. The articular lesions were among the first manifestations of the disease It is thought that the joints are affected insidiously and early perhaps in the immediate neonatal period or even during fetal life

The first sign of visceral involvement occurred when the lesions of the skin and joints were moderately advanced. The exact onset of involvement of the central nervous system was difficult to ascertain Onset of visceral involvement in organs other than the central nervous system became apparent late in the disease All 3 patients had pulmonary lesions terminally but x rays revealed that in each the lesions

(9) J Mt. Sinai Hosp New York 24 816-837 Nov Dec 1957

began 5 months or more after onset of the disease Another late lesion, which appeared secondary to the original process was the juxta articular destructive lesion of bone This was distinctive by x rays but did not cause further symptoms Such lesions were present in all 3 patients and occurred most characteristically at the sigmoid notch of the ulna (Fig 55) The changes in the bones were found at autopsy to be caused by invasion by nodular infiltration from the involved adjacent joints

At autopsy the hearts of 2 patients showed a few yellowish brown nodular areas on the pericardium valves and chordae

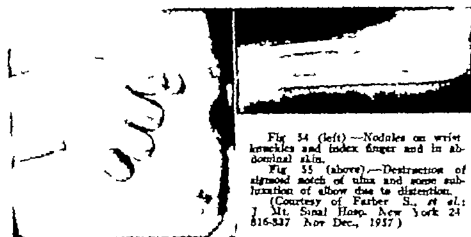


Fig 54 (left) —Nodules on wrist knuckles and index finger and in abdominal skin.

Fig 55 (above).—Destruction of sigmoid notch of ulna and some subluxation of elbow due to distention.

(Courtesy of Farber S., et al.: J Mt. Sinai Hosp. New York 24 816-837 Nov Dec., 1957)

tendineae (Fig 56) On section these nodules consisted of many macrophages and foam cells surrounded by and intermingled with areas of granuloma formation.

The joints of 1 patient were not severely infiltrated and granuloma did not occur in the joint capsules By contrast, another patient presented a pathologic picture in the joints and nodules in which massive involvement by granuloma predominated, though many foam cells were interspersed in the lesions (Fig 57) The third patient represented an intermediate stage in the composition of joint and nodular lesions This evidence points to the probability that in the genesis of the systemic lesions lipidization of macrophages is a late reaction and granuloma formation an even later one The earliest reaction which could be discerned was one of simple fibrosis and accumulation of nonfoamy macrophages The pathologic picture in the lung supported these conclusions

Pulmonary involvement in all 3 patients was extensive The





Fig 56 (left) —Thickening of chordae tendineae and nodule s fringe at attachment of mitral valve

Fig 57 (above) —Hip showing extensive thickening of ligamentum teres and capsule. Pannus covers large part of acetabulum.

(Courtesy of Farber S., et al, J Mt Sinai Hosp, New York 24 816-837 Nov Dec., 1957)

bizarre joint symptoms and subcutaneous nodules suggested an initial diagnosis of rheumatoid arthritis to many observers However biopsy of a lymph nodule and subcutaneous nodule revealed the collection of foam cells and permitted the diagnosis of lipogranulomatosis

► [Although the pathogenesis of lipogranulomatosis remains obscure, this paper will be of value to any physician who has a patient whose symptoms and findings place the diagnosis within the area of this group of related or similar diseases —Ed.]

Osteoarthritis of Sternoclavicular Joint, accompanied by pain was found in 12 women aged 30-60 in a study undertaken by J Arlet and P Ficat[1] (Toulouse France) Pain was usually moderate and of short duration but 2 of the younger women had very severe pain lasting 1½ and 4 years respectively It radiated to the lateral aspect of the neck to the shoulder joint and breast and was increased by pressure and by active shoulder motion particularly abduction

Examination revealed firm hypertrophy of the proximal end of the clavicle in all patients X rays showed general enlargement of the proximal end of the clavicle in 12 and condensation in 10 In 7 patients an osteophyte was found growing outward from the inferior margin of the end of the clavicle

(1) Ann Rheumat. Di 1 9 100 March, 1958

In all but 2 patients simple measures (aspirin phenylbutazone and/or local injection of hydrocortisone acetate) caused complete disappearance of pain In the 2 younger women severe pain persisted despite medical treatment and x ray therapy in 1 and use of a plaster cast in the other In these cases surgical resection of the proximal end of the clavicle was performed (Fig 58) with a good result in both Diagnosis was confirmed by histologic examination of the surgical specimens

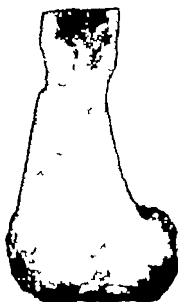


Fig 58—Precocious osteoarthritis of left sternoclavicular joint. (Courtesy of Arlet J., and Ficat P Ann. Rheumat. Dis. 17 97 100 March 1958.)

► [Surgical resection of the sternal end of the clavicle to relieve persistent pain *or marked deformity* caused by osteoarthritis is a most worthwhile procedure. The results have been consistently gratifying —Ed.]

The Patella in Degenerative Joint Disease Clinicopathologic Study Robert A Haliburton and C Roger Sullivan[2] (Mayo Clinic and Found.) reviewed the records of 85 females and 51 males who underwent patellectomy for degenerative disease of the patellofemoral joint. The patellas were worn out on the lateral side and had a characteristic appearance The higher incidence of this disease in women is probably the result of increased tendency for the patella to displace laterally either from dysplasia of the joint or from the more acute valgus alinement of the knee in women

All patients had pain associated with locking instability stiffness crepitus or swelling Physical findings were tenderness crepitus effusion and limitation of motion The most frequent predisposing conditions were trauma (commonest in men) recurrent dislocation of the patella and obesity An etiologic factor was present in 89

On examination 119 patellas from 109 patients were graded according to the degree of degenerative change. They were classified in three groups grade 1 cartilage degeneration with absence of or slight marginal hyperplasia (28)

(2) A.M.A. Arch. Surg 77 67-483 November 1958.

grade 2 cartilage degeneration with well marked marginal hyperplasia (58) and grade 3 gross distortion in patellar shape with eburnation of articular surface (33)

Follow up period was from 2 to 7 years and 74 (68%) patients gave their evaluation of the results. Only 1 was worse Best results were in grade 3 patients 61% of whom reported no pain

Radiologic Assessment of Osteoarthrosis. J H Kellgren and J S Lawrence[3] assessed observer difference in reading x rays for osteoarthrosis The following x ray features were considered evidence of osteoarthrosis (1) formation

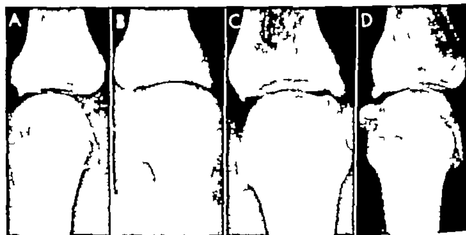


Fig. 59—Osteoarthrosis of metacarpophalangeal joint A D grades 1-4 (Courtesy f Kellgren, J H and Lawrence J S. Ann Rheumat. Dis 16 494-502, December 1957)

of osteophytes on the joint margins or in the knee on the tibial spines (2) periarticular ossicles found chiefly in relation to the distal and proximal interphalangeal joints (3) narrowing of joint cartilage associated with sclerosis of subchondral bone (4) small pseudocystic areas with sclerotic walls situated usually in subchondral bone and (5) altered shape of the bone ends particularly in the head of the femur

X rays of 11 joints in 85 persons aged 55-64 chosen at random were read for osteoarthrosis by 2 observers first together so that agreed standards for grading could be determined and then separately after an interval All observations were made without knowledge of the symptoms or clinical state or of the previous readings

The authors divided the x ray appearance of osteoarthrosis

(3) Ann. Rheumat Dis 16 494-502 December 1957

into 5 grades none (0) doubtful (1) minimal (2) moderate (3) and severe (4) Grade 0 indicated a definite absence of x ray changes of osteoarthrosis The grading for groups of joints e g the distal interphalangeal joints of the hands

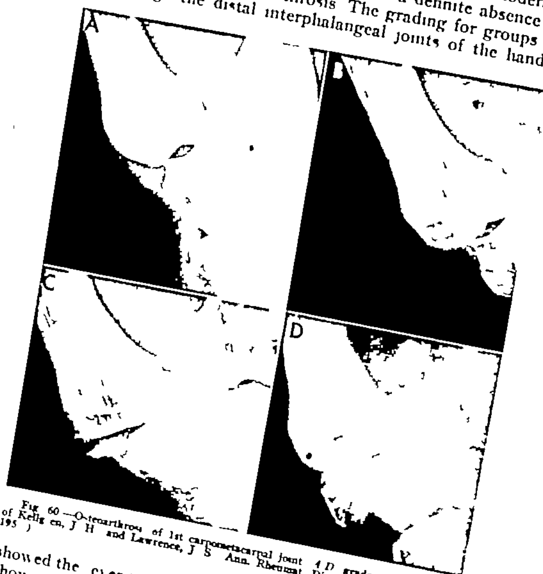


Fig 60 —Osteoarthrosis of 1st carpometacarpal joint A-D grades 1-4 (Courtesy of Kellgren, J H and Lawrence, J S Ann. Rheumat. Dis. 16 494-502 December 195)

showed the severity in the most affected joint Figures 59-61 show standard examples of grade 1-4 severity

A significant correlation between the readings of the 2 observers was obtained for all joints except the wrist. The estimates of prevalence however varied widely because of the cumulative effect of observer bias (±31%) It is felt that comparison of prevalence estimates by different observers could have little value in population studies Two readings

by the same observer gave only a slightly better correlation on the reading of individual x rays but by excluding observer bias they gave a much closer estimate of prevalence (±5%) These 2 readings however differed substantially from the mean value for all readings (—8 and —17%) A

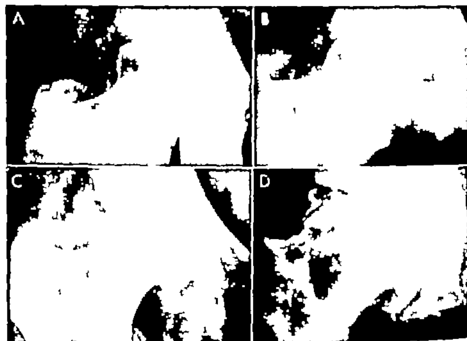


Fig 61—Osteoarthrosis of hip, *A-D*, grades 1-4 (Courtesy of Kellgren, J H and Lawrence J S Ann. Rheumat. Dis. 16 494-502 December 1957)

combined reading by two observers reduced the influence of personal bias and differed little from the mean value (—3%)

It is suggested that if possible in all population studies in which it is desired to compare the x rays should be read by the same observer or preferably by two observers in consultation

► [Osteoarthritis or osteoarthrosis, a term which the authors prefer is the result of wear and tear It is much more common in joints in which the articulation has been disturbed as the result of an injury congenital anomaly or deformity developing during the period of growth The fact that x ray technics and the interpretations of different roentgenologists of equal training and experience vary considerably is well brought out in this presentation It could be added that osteoarthrosis affects the posterior lateral articulations in the cervical spine, which are sometimes called the joints of Luschka, at least as commonly as it does the more posteriorly placed apophysial joints. The changes in the joints of Luschka can be clearly shown if anteroposterior roentgenograms are made while traction is being applied to the cervical spine —Ed]

Clinical Features and Course of Ankylosing Spondylitis As Seen in Follow up of 222 Hospital Referred Cases M Wilkinson and E. G L. Bywaters[4] (Postgrad Med School London) traced and studied 212 of 222 patients with ankylosing spondylitis treated between 1940 and 1955 There



Fig. 62—Ankylosing spondylitis involving cervical spine with onset at age 19 Note abnormal shape of vertebral bodies, possibly due to abnormal growth at ring epiphyses.
(Courtesy of Wilkinson M., and Bywaters, E. G. L. Ann. Rheumat. Dis. 17: 209 228, June, 1958.)

were 17 deaths In none was the arthritis a direct cause, but in 1 it was contributory and 3 resulted from probable complications of radiotherapy

The sacroiliac joints were affected in all patients. Early changes were best shown by the anteroposterior view as in some instances the oblique views appeared normal in the early stage of disease Next in frequency of involvement were the lumbar thoracic and cervical spine The extent of spinal involvement was greater in patients with long-standing disease (Fig 62) The hips or shoulders were involved in 39%

(4) Ann. Rheumat Dis. 17.209-228, June 1958

of patients and the peripheral joints in 24% About a fourth of the patients had osteolytic lesions or what is presumably the healed stage of such lesions—areas of irregular cortical bone at sites around the pelvis upper femur or feet

Despite illness of over 20 years functional capacity may be remarkably little impaired when allowance is made for age 63% of patients were employed in full time light occupation whereas only 18% were severely deformed

Of the patients who had had symptoms for 5 years or less 81% had a chest expansion of 2 in or less and 19% of less than 1 in After more than 20 years of spondylitis the corresponding figures were 96% and 62% A raised erythrocyte sedimentation rate was frequent even in long standing and apparently inactive disease.

Radiotherapy was given to 200 patients on one or more occasions it seemed to arrest disease activity only temporarily The proportion of patients with a symptomatic relapse after radiotherapy rose from 67 4% at 1 year after treatment to 90% after follow up periods of over 10 years

Uveitis occurred in 25% of patients In most it was unilateral often recurrent but sometimes involving each eye alternately

Irradiation Therapy of Pigmented Villonodular Synovitis is discussed by Milton Friedman and Emanuel E. Schwartz[5] (Hosp for Joint Diseases New York) Primary pigmented villonodular synovitis is most common in young adults This is particularly true of the radiosensitive variety The disease is insidious starting with swelling tenderness and impaired motion of the joint usually the knee Local heat or redness is rare as this is a granulomatous reaction of tissue. Aspiration characteristically yields a hemorrhagic or brownish red fluid containing hemosiderin X rays reveal nodular densities or thickened synovium within the joint space or in the region of its bursae. The adjacent bones are normal except for disuse osteoporosis Occasionally degenerative arthritis or other joint derangement may underlie a secondary or superimposed pigmented villonodular synovitis

Surgical exposure of the joint reveals localized nodulation or diffuse papillary thickenings of the synovium which appear brownish yellow or hemorrhagic. Occasionally there are yellow xanthic nodules

(5) Bull. Hosp Joint Dis 18 19 32, April, 1957

Histologic appearance depends on the stage of the disease. There is proliferation of local tissue histiocytes some of which may contain cholesterol (foam cells) and some hemosiderin. There are many delicate, small blood vessels and phagocytic giant cells. The synovial lining cells may be hyperplastic and form one or more layers. Later in the disease there is diffuse hyalinization of the stroma and in some in

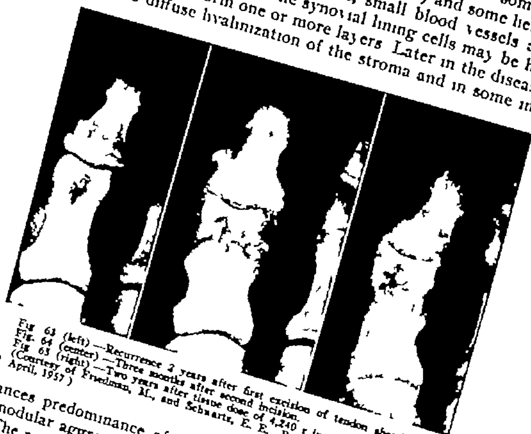


Fig. 63 (left).—Recurrence 2 years after first excision of tendon sheath lesion.
Fig. 64 (center).—Three months after second incision.
Fig. 65 (right).—Two years after tissue dose of 4,240 r in 28 days.
(Courtesy of Friedman, M., and Schwartz, E. E. Bull. Hosp. Joint Dis. 18:19-32, April, 1957.)

stances predominance of cholesterol-containing histiocytes in nodular aggregations forming a xanthoma.

The author used x rays successfully in the treatment of 8 of 10 patients most of whom were young adults. The disease had been present for 4-22 months. In 7 patients aspirations were performed 1-14 times per patient. These yielded blood-tinged or brownish fluid. The amount of radiation ranged from 1,326 r in 8 days to 3,200 r in 24 days. Two patients were not benefited by x-ray therapy. Both had lesions that were atypical in that pigmented villonodular synovitis was superimposed on a more serious underlying disease, i.e., they were secondary lesions.

A less common form of pigmented villonodular synovitis is associated with a tendon sheath and invades the adjacent

bone forming a cystic defect. Occasionally the periosteum between the bone and the extraosseous lesion is intact making it difficult to understand the relation between the two parts of the lesion (Figs 63-65) This lesion is curable by x irradiation but seems to require larger doses than pigmented villonodular synovitis limited to a synovial cavity

Effect of Estrogen Androgen and Thyroid in Degenerative Joint Disease was studied by A A Hellbaum W K Ishmael M L Duffy and K W Payne[6] (Oklahoma City) Androgens and estrogens function in the aged of both sexes to enhance protein anabolism and favorably affect mineral metabolism in bone Both these hormones reduce urinary and fecal calcium excretion in osteoporosis and in combination they are more effective than either alone. Desiccated thyroid has been extensively used largely on an empiric basis in elderly patients This hormone is essential for normal bone development and maintenance as well as for functional integrity of nerve and muscle tissue

The response to anabolic hormones of 431 patients with degenerative joint disease was evaluated About a third were studied by a double-blind technic a placebo and combinations of estrogen and androgen with and without thyroid being used Results were similar to those obtained with known preparations Of 182 patients given an estrogen androgen combination 68% improved Of 176 who received an estrogen androgen with thyroid globulin (Proloid[†]) combination 143 (81 3%) were benefited Placebo alone was given to 47 patients with some improvement in 13 (27 6%) Episodes of uterine bleeding occurred in 3 elderly patients and acne in 2 other women

After administration of the combined hormones dramatic pain relief was experienced by some patients occasionally within a few days This effect became evident so rapidly that it was not likely related to a change in the bone matrix The substance must exert some other influence Most patients improved only after several months of therapy

Extended Sympathectomy in Treatment of Chronic Arthritis Robert A Herfort[7] (St Agnes Hosp White Plains N Y) used extended lumbar sympathectomy encompassing lumbar sympathetic ganglions with accessory ganglions and

(6) J Ger 1 13 163-166 April, 1958.
(7) J Am Geriatrics Soc 5 904-915 November 1957

decussating fibers, as a procedure for denervation of joints of the lower extremities of 7 patients with advanced painful arthritis. Six obtained relief from articular pain which lasted for follow up periods of 4 24 months The single therapeutic failure was due to a technical difficulty at operation which precluded safe removal of the 2d lumbar ganglion Evidently resection of the sympathetic chain should be proximal to the 2d ganglion for adequate knee joint denervation Extended lumbar sympathectomy can be safely done by an oblique incision in the flank extending caudad from the 11th rib The high approach of Lilly, with resection of the 11th and 12th ribs has not been found necessary

There was no morbidity even in the aged (except wound infection in 1 patient) Intra- and postoperative shock did not pose problems and transfusion was not necessary The operation is safe even in cases of prolonged immobilization and invalidism so common in patients with advanced arthritis of the lower extremities Charcot like arthropathy was not seen in any patient at follow up examination Moreover neuropathic joints have not been reported after sympathetic denervation surgical or chemical for any indication

A theoretical objection to denervation for pain relief in arthritic joints is that less pain permits the patient a degree of physical activity which would increase stress on a previously damaged joint surface Actually after surgery these patients found that prolonged weight bearing and articular motion produces a vague sensation of localized fatigue in the denervated area which provides a warning against continued activity

► [Failure of *partial* sympathectomy to produce satisfactory results in the treatment of rheumatoid arthritis caused the operation to be regarded with disfavor There is good reason to believe that poor results were due to failure on the part of the surgeon to do a thorough excision of sympathetic ganglions, accessory ganglions and decussating fibers. I have a small series of patients who were subjected to extensive sympathectomy 15-20 years ago and are still happy with the results.—Ed.]

Protracted Uricosuric Therapy in Tophaceous Gout was studied by A B Gutman and T F Yu[8] (Columbia Univ) Formation of new tophi can be halted and established tophi made to disappear by protracted treatment with suitable uricosuric agents. The increased urinary excretion of urates so induced lowers the serum urate level and reverses the flow of urate from circulating fluids to tissues Prolonged nega-

8) Lancet 2 1258-1260 Dec. 21 1957

tive urate balance supervenes and the body pool of urate, including solid deposits, is thus reduced This treatment was given to 82 patients with tophaceous gout, who received sustained therapy with uricosuric drugs for 6-84 months In none did new tophi appear after the uricosuric regimen was fairly started and maintained In 36 patients the tophi that were already formed greatly decreased in size or disappeared in 31, response was unequivocal but only moderate or slight and in 15 there was no apparent change in the size of tophi

Impaired function of one or more joints with pain due to chronic gouty arthritis was present in 52 patients In 37 there was complete resolution of joint disability and in 12 improvement was moderate or considerable Forty seven had complete relief from pain and 3 were somewhat improved. The causes of failure may be classified into two groups (1) inadequate uricosuric response and lowering of the serum urate level due to impaired renal function insufficient dosage because of drug intolerance or precipitation of renal colic or immoderation in diet and (2) adequate uricosuric response and disappearance of some but not all of the patient s tophi. Some tophaceous deposits apparently are inaccessible to humoral agents perhaps because of poor vascularization and therefore are refractory

The large doses of salicylates required for effective uricosuric response inevitably induce the discomforts of salicylism The authors used chiefly probenecid Even with 2 3 Gm /day it is impossible to lower the serum urate level below 7 mg /100 ml. in many gouty patients notably those with overt renal damage. Probenecid is devoid of antirheumatic and analgesic properties a handicap when severe joint stiffness or chronic pain resists concurrent administration of prophylactic colchicine because relief is obtained only after some months when the urate deposits in the joint tissues have been sufficiently mobilized Probenecid also tends to provoke attacks of acute gouty arthritis when first given, as occurred in 17 of the patients

The compounds G 25671 which contains a phenylthioethyl group in place of the butyl side chain of phenylbutazone and G 28315 the sulfoxide of G 25671 have been tried as uricosuric agents They are more potent than probenecid,

effectively lower the serum urate level and mobilize tophi in some patients resistant to probenecid G 25671 also has mild analgesic properties sufficient to afford prompt relief from joint stiffness and pain in most of the patients with chronic gouty arthritis who had discomfort when treated with probenecid

Because of great individual variations in response to uricosuric medication the optimal drug and its dosage are best established by direct measurement in the candidate for therapy The 24-hour urinary excretion of urate and the serum urate level are determined while the patient is on a low-purine, low fat restricted protein (60-80 Gm a day) diet. Standard daily dose of the preferred uricosuric agent is given The urine urate and serum urate levels are redetermined and dosage is adjusted accordingly In 50% of the patients optimal dosage of probenecid was 0 5 Gm a day Ordinarily reg ulation of dosage is aimed at effecting 50-100% increase in daily urinary excretion of urate and lowering of the serum urate level to normal (below 6 mg /100 ml.) These objectives may not be attainable particularly in gouty patients with renal damage and extensive tophi but negative urate balance with disappearance of tophi appears attainable in many patients when the serum urate level remains about 7 mg /100 ml

Successful Therapy of Fibrositis is described by Richard T Smith[9] (Benjamin Franklin Clinic, Philadelphia) Fibrositis should be suspected when aching and stiffness after inactivity (jelling) are complained of irrespective of additional symptoms. The jelling phenomenon can be differentiated from actual pain in the joint because the pain occurs and becomes more severe when the joint is made to function. Arthritis of any type is usually associated with some chronic fibrositis because of the limited activity occasioned by the pain. Fibrositis has been regarded as a psychogenic type of disability It can be readily differentiated from psychogenic rheumatism in which there is bizarre anatomic distribution of complaints and characteristic symptom pattern Acute fibrositis is generally of short duration even if untreated. Heat applications for 20 minutes or more, 1-3 times daily and use of salicylates relieve the discomfort The patient should be

(9) J Am. Geriatrics Soc. 6 147 156, February 1958.

advised to resume normal or nearly normal activity without delay

The modern tridirectional attack involving relief from symptoms improvement of function and elimination of cause can cure chronic fibrositis in a matter of weeks The aching pain is relieved partially or completely with salicylates or analgesic combinations The patient is not promised complete relief Medication is given every 4 hours during the first several weeks of therapy whether the patient feels the need for it or not There should be no need for narcotics or systemic steroid therapy in treatment of fibrositis. Heat from an infra red lamp or a heating pad applied for 20 minutes or more 1 3 times a day is soothing and aids in relief from pain and stiffness Massage is likewise comforting These measures cannot be used as a substitute for exercises because they in no way rehabilitate muscle

The most recent adjunct in treatment of fibrositis is infiltration of steroid suspensions into the most painful areas. Hydrocortisone acetate suspension (25 mg/cc.) hydrocortisone tertiary butylacetate (25 mg/cc.) and prednisolone tertiary butylacetate (20 mg/cc.) have been helpful. These preparations may be used alone or the first and second or the first and third may be used combined When fibrositis involves the shoulder or torso area 2-4 different exercises performed 10 times 4 times a day will rehabilitate the muscles These limits are placed on the number of muscular contractions during each session to prevent fatigue All activity must stop short of fatigue

Psoriatic Arthritis The criteria for diagnosis of psoriatic arthritis are according to John W Carrier[1] (Central Maine Gen'l Hosp Lewiston) cutaneous psoriasis of long duration parallel exacerbations and remissions of joint symptoms cutaneous lesions and typical atrophic joint changes Pronounced periosteal reaction after minimal trauma is possibly a related finding in the systemic form The disease may have two distinct phases acute juvenile and chronic adult.

X ray findings are essentially those of trophic arthritis. The changes may be summarized as initial osteoporosis followed by increased density of the involved bones diminished joint space and erosion of the joint surfaces with atrophy of

(1) Am. J Roentgenol. 79 612-617 April, 1958.



Fig 66 (left) —Right 5th metatarsophalangeal joint in youth, 19
Fig 67 (right) —Right foot of man, 56 showing destructive changes in 1st and 2d toes.
(Courtesy of Carrier J W Am. J Roentgenol. 79 612-617 April, 1958.)

the shafts and in advanced disease essentially complete destruction of the extremities of the bones so that they are atrophic and tapered (Figs 66 and 67)

FRACTURES DISLOCATIONS AND SPRAINS

Experimental Study of Overgrowth after Fractures was conducted by Nicholas R. Greville and Joseph M Janes[2] (Mayo Clinic) on 25 puppies 3-4 months old The study included a control group and 4 experimental groups with 5 puppies to a group

Three small stainless steel screws were inserted into a femur of every member of the control group In the experimental groups 1 femur of every animal was fractured.

The insertion of screws into the diaphysis and epiphysis in

(2) Surg., Gynec. & Obst. 105 717-721 December 1957

the control group did not cause increased growth In the experimental group there was increased growth in all animals This increase came entirely from the epiphysis and varied according to type of fracture and displacement.

No difference was found in growth increase between bones in which the nutrient artery was ligated and those in which it was left undisturbed There was increased growth of the lower fragment in all the animals The increase occurred at the lower femoral epiphysis and varied directly with the displacement In the undisplaced fractures the increase was greater when the fracture was oblique

► [There is excellent evidence to support the theory that any injury to a growing bone, whether it is due to bacterial infection or to trauma, if it does not cause damage to the growth cartilage cells will be followed by acceleration of bone growth. The overgrowth which occurs after a fracture continues as long as hyperemia of repair persists The study reported by Greville and James tends to reconfirm this theory —Ed.]

Compression of Bone Ends as Aid to Union in Fractures Report on 49 Ununited and 4 Recent Fractures. Thomas King[3] (Melbourne Australia) compressed 49 ununited fractures after the bone ends had been countersunk by open operation with 1 exception 41 fractures (83.7%) united. Of the 13 with sinuses before operation 12 united. When the fractures united the sinuses healed. Four recent fractures with gross displacement united.

The fractures may be transverse comminuted or oblique. In transverse fractures the object is to avoid engaging the dense cortical bone at the pressure surfaces (Fig 68) The bone end with the larger diameter is reamed or countersunk and the medullary cavity is opened by a drill or gouge. The end with the smaller diameter is sharpened or pointed and again the medullary cavity is opened by a drill. As a result, the surfaces in contact especially in the upper end of the tibia and in the supracondylar region of the humerus consist almost entirely of cancellous bone The operation should be performed with conservative exposure thereby avoiding unnecessary disturbance to the blood supply of the bone. A tourniquet is not applied the two bone ends should bleed Bone chips from the ilium are unnecessary but bone derived from the shaping of the countersunk bone end is run through a bone mill and packed around the fracture site Several 9/64-in drill holes are made in the bone near the fracture site to promote revascularization

(3) J Bone & Joint Surg 39 A 1238-1248 December 1957

In oblique and comminuted fractures the countersinking of one fragment into the other would result in too much shortening of the limb However the same principle as that in transverse fractures is used to avoid the compression force causing shortening a pointed end is engaged into the medullary cavity of the other fragment Thus at least one cancellous surface is in contact.

Fracture of the lower end of the humerus is suitable for compression as it is a common site for nonunion and infection Compression is an excellent method of immobilization, especially if there is a tendency to resorption of the bone ends after operation The proximal end is pointed and countersunk into the lower end The tendency to angulation when compression is applied can be avoided by introducing 1 or 2 intramedullary 3/32 in rods just proximal to the coronoid fossa and from the lateral side of the humerus before insertion with an electric drill of the 2 Kirschner wires used for the compression Thereafter the speed of the Kirschner wires in the drills deflects their pointed ends from the intramedullary rods

The author no longer uses compression for fractures of the radius and ulna, as unequal shortening of the bones has resulted in subluxation of the distal radioulnar joint The femoral shaft is not suitable for compression, because there is little cancellous bone to be compressed except in the lower end.

The ideal location for compression of fractures of the tibia is in the upper half of the shaft where there is cancellous bone. If the fracture is transverse the lower pointed end is countersunk into the upper (Fig 68) The fibula must be refractured Internal fixation with Eggers plates may be used but is better avoided so as to preserve the blood supply to the bone ends by a conservative exposure

Greifensteiner s method of compression with 2 Kirschner wires stretched in a stirrup is useful in the upper extremities where important vessels and nerves must be avoided. In the lower extremities it is necessary to have wide stirrups or to weld a length of steel in the bow The hole in the wire stretcher should be large enough to hold 2 Kirschner wires Before drilling the two fragments about 2 in from the fracture site and on either side the wound should be temporarily closed with 2 towel clips Otherwise it is not possible to close the wound later on account of the wires lying in it instead

of piercing the skin The wires are stretched in the stirrup until they are taut and when tapped produce a ting there is only slight movement when the bone fragments are rocked By experiment and measurement it has been found

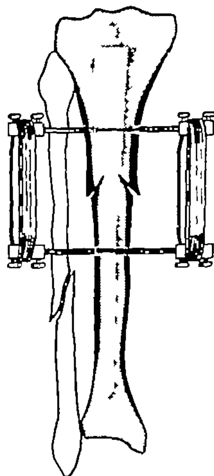


Fig 64—Compression with Steinmann pin and heavy rubber bands (Courtesy f King T J Bone & Joint Surg 39-A 1238-1248, December 1957)

that the tension of the wires maintains this position when there is a pressure of about 25 lb

If an end of an 8×3/16-in Steinmann pin is clamped in a vice and the other end connected by a heavy rubber band to a spring scale the nail just begins to bend when the scale reads about 25 lb The nail should be drilled (never hammered) into the bone at least 2 in from the fracture site and through the skin after temporary closure of the wound Caps that are placed on the nail ends prevent the rubber bands

from slipping and causing pressure on the skin (Fig 68) Wool padding is used to cover the pins or stirrups and the whole limb This padded cast is removed with the pins or wires after 4-6 weeks A new unpadded cast is then applied The period of compression is 4 weeks for the humerus 4-6 weeks for the tibia and 6 weeks for the femur

The real value and place for compression is in treatment of infected and ununited fractures especially those in the lower third of the humerus and in the upper half of the tibia Apparently it is the greater amount of cancellous bone there that favorably affects the results of compression Although no special complications arose in connection with the transfixion pins and wires it appears inadvisable to use them in recent fractures for compression especially if the fracture is near a joint.

► [Distraction between fracture fragments so that there is no contact and hence no compression is the most common cause of nonunion in the treatment of noninfected fractures King has confirmed the contention of Key Charnley and Eggers that physiologic compression between fracture fragments hastens union of the fractures His success in obtaining healing of infected and ununited fractures by using this technic is noteworthy —Ed.]

Küntscher Method of Intramedullary Fixation is discussed by Gerhard B G Kuntscher[4] (Schleswig Hesterberg) Intramedullary nailing of fractures requires no external fixation or special postoperative care The basic principle is stable osteosynthesis through flexible impingement of the nail in the bone The nail must be wide enough to occupy the entire cross section of the medullary canal and to bear the body weight and stresses of the musculature Even in fresh fractures this often requires the use of reamers to widen the entire length of the medullary canal The method is not limited to fractures or pseudarthroses in long hollow bones but can be used advantageously after osteotomy and arthrodesis

Any method of treating fractures should aim at complete immobilization of the fragments during healing Methods of external splinting such as plaster casts cannot accomplish this satisfactorily because fragments encased in soft parts such as the muscles and fatty tissue are still capable of considerable motion The splint must be fitted directly to the bone It should be inserted into the medullary canal and not affixed to the outside of the bone where it damages the periosteum which plays a major role in callus formation and

(4) J Bone & Joint Surg 40-A 17 26 January 1958.

bone nutrition Outside pressure on the bone causes atrophy whereas inside pressure thickens the bone. The correct method, therefore is intramedullary fixation

Distinction should be made between two basically different methods of intramedullary fixation namely the use of a pin and the use of a nail Nailing involves not only longitudinal elasticity afforded by the Rush pin but also elastic compressibility in cross section The latter cannot be achieved with a nail that is solid in cross section It requires a nail of clover leaf design compressible in two directions Lateral movement can be eliminated only if the nail occupies the entire width of the medullary canal and almost all the length. *An elastic nail is compressed in the narrow portions and can* be made to span the wider portions

Bone resorption will occur about any foreign body and will soon loosen a solid rod even though at first this rod may have accurately fit the width of the canal A nail with a compressible cross section, however will expand during bone resorption

To achieve maximum stability it is advisable to use the longest nail possible. The entire length of the medullary canal can thus be exploited for purposes of mechanical retention

Any external splinting such as with a plaster cast is meaningless and harmful An invaluable advantage of intramedullary fixation is that it eliminates the dangers of immobilizing the joints and muscles and thus prevents local and general circulatory disturbances It shortens hospitalization and hastens return to normal activities In fractures of the *lower limb ambulation and weight bearing are possible* after an average of 8-10 days Even elderly persons can be out of bed a few hours after surgery No special postoperative care is needed

If pseudarthrosis develops or if the nail bends or breaks these occurrences can be traced primarily to using the wrong size nail

Reaming the medullary canal is the final and most important step in intramedullary nailing In many instances such as in fractures of the forearm the operation is inconceivable without this procedure The entire length of the medullary canal is reamed Although the diameter of the reamer used corresponds exactly to that of the nail elastic

impingement is nevertheless assured Intramedullary nailing is thus indicated even in cases in which the nail is not thick enough to span the widest portions of the medullary canal Reaming will remove constrictions facilitating the insertion of a sufficiently wide nail If the entire medullary canal is too narrow it is reamed wide enough to accommodate a nail of sufficient thickness to withstand muscle stresses

The operation destroys the nutrient artery and the endosteum and removes the bone marrow However animal experiments and clinical experience have proved that these losses have no effect on the bone or on healing after a fracture or after osteotomy Infection can be checked by antibiotics The perfecting of reduction instruments has facilitated closed nailing of fresh fractures without exposure of the fracture site. Also with these instruments osteotomy can be performed with assurance that the periosteum will remain in contact with the bone and the surrounding soft tissues

► [One of the most notable contributions that came out of the experiences of surgeons during World War II was that of Kuntscher who introduced a method of intramedullary fixation for fractures of the shaft of the femur and other long bones. The indications and principles of this method of treating fractures are effectively demonstrated by the originator —Ed]

Conservative and Surgical Treatment of Fractures in Children. J Verbrugge[5] (Ghent Belgium) considers conservative treatment preferable with surgery reserved for exceptional cases Fractures are easier to treat in children than in adults and their course is more favorable more simple and more consistent The reasons for this are the extraordinary plasticity of the bone certain and more rapid formation of callus easier and more complete recuperation of immobilized joints more complete and spontaneous recuperation of the musculature and absence of sinistrosis Among 350 patients treated by general practitioners reduction was good in 264 and results excellent. Of 86 with poor reduction results were excellent in 61 fair in 16 and poor in 9

Osteosynthesis is necessary in some patients with chronic pseudarthrosis acquired or congenital and for badly united fractures Surgical treatment was done on 163 patients most of whom were age 6-9 (oldest 15) The fracture sites were the elbow in 56 femur in 35 forearm in 33 thigh in 19 humerus in 8 hip in 7 knee in 2 clavicle in 2 and maxilla in 1 Follow up (2 20 years) revealed good results in 159 average

(5) Lyon chir 54 503-515 Jul 1958

in 3 (joint stiffness of ±50%) and poor in 1 (synostosis of the elbow) Slight transient infection occurred in only 2 patients

Many of these patients were operated on before stainless steel and Vitallium were available Since the advent of these materials the opinion is that use of the older metals should be abandoned. On the basis of his experience, the author believes that this situation should possibly be reinvestigated. Long term results have been good with soft iron and ordinary steel which are partially absorbable and with aluminum which is slowly absorbed In 34 patients treated with magnesium (97% magnesium with 3% aluminum) cure was accompanied by formation of hydrogen gas This metal is absorbed in less than a year The author intends to make additional tests with this metal in combination with cadmium or a metallic reducing substance to slow the rate of absorption

Lengthening of diaphyses has been observed by all surgeons The author believes this occurs in all cases but sometimes is too slight to be recognized It seems probable that a period of hyperfunction of cartilage after a fracture is succeeded by hypofunction which re-establishes equality of length In 2 patients elongation of the femur exceeded 3 cm after union but balanced length was established after 4 or 5 years In 28 fracture patients treated conservatively 25 showed diaphysial lengthening whereas in 26 treated surgically lengthening occurred in 11 In 4 patients (2 treated conservatively and 2 by osteosynthesis) with fracture in the region of the femoral diaphysis there was 3-4 mm widening of the inferior epiphysis

Isolated Fractures of Atlas according to Andre Sicard Jean Picard and Herve Martin[6] (Paris) are considered rare because they are difficult to diagnose roentgenologically and hence are often unrecognized The authors report 5 cases 4 of them seen within a short period

CASE 1 —Man 34 had a fracture of the posterior arch caused by direct shock from a backward fall Because of persistent pain, x rays were taken a week later The lateral view (Fig 69) showed the fracture, but the anteroposterior view was normal There was no luxation and the odontoid process maintained its position. The fracture healed spontaneously and without sequelae.

CASE 2 —Woman 23 sustained a fracture, probably bilateral from

(6) J chir 75 521 538 May 1958

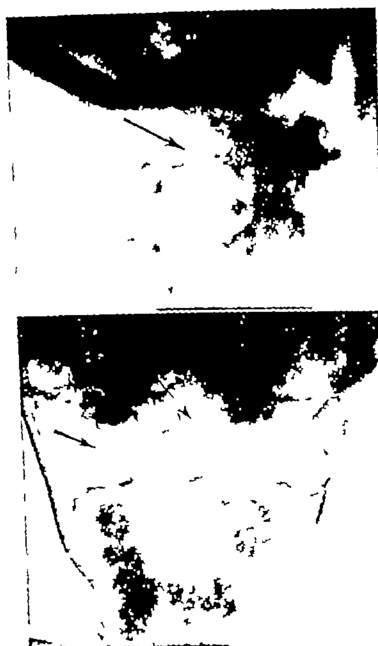


Fig. 69 (top) —Right unilateral fracture of posterior arch. Arrow shows posterior weak point.

Fig. 70 (bottom) —Fracture visible below space separating superior left incisors. Light unwedging outside right lateral mass interpreted as fracture separation.

(Courtesy [illegible] Sicard, A., et al J chir 5 521 538, May 1958.)

indirect trauma caused by an automobile collision. Pain was moderate head movements were practically normal and there were no neurologic signs Healing was spontaneous

CASE 3 —Woman, 52, had fracture separation of the atlas which resulted from a fall downstairs but was not diagnosed immediately after

the accident. Severe head and neck pain with limitation of movement, persisted and increased. A second roentgenologic study with tomograms, over a month after injury showed a vertical and median fracture of the posterior arch fracture of lateral masses with sliding outward, especially marked on the right tearing of the tubercle at the insertion of the transverse ligament and deviation of about 1 cm. between fragments in the anterior arch The neck was immobilized in plaster in slight extension for 3 months and an excellent recovery resulted

CASE 4—Boy 6, sustained a unilateral left fracture of posterior arch of the atlas (Fig 70) from a fall causing forced hyperextension of the head. Atloid axoid slipping was confirmed by tomography which demonstrated the necessity for median exposures to avoid false images If causal trauma and pain in the nucal fossa had been lacking the hypothesis of a congenital anomaly due to failure in closure of the neural arch could not have been excluded.

CASE 5—Man 68, had fracture separation of the atlas associated with a sinking fracture of the 8th dorsal vertebra Because of diffuse pain, systematic radiologic study was made of the upper cervical region which revealed the atloid fracture.

Clinical findings are of little value in diagnosis of a fracture of the atlas they can only indicate existence of a lesion in the suboccipital region Radiologically it is inadvisable to rely on anteroposterior exposure and a lateral view of the cervical spine. The fracture is not visible except in an excellent lateral exposure centered on the first two cervical vertebrae or in the two classic views through the buccal cavity and the cavum The occipital plate position is also good. Tomography in narrow sections is the only examination which permits precise localization Interpretation of the films is important since the lesions are not always evident.

Treatment must be individualized. Isolated fracture of the posterior arch often needs no treatment and when it does, simple immobilization for 3 or 4 weeks is usually sufficient. Isolated fracture of the anterior arch should be similarly treated, though in some cases the head may be immobilized by a leather or celluloid collar to avoid hyperextension Fracture of lateral masses may require more active treatment although lesions of the cerebrospinal axis if not occurring immediately are unlikely to do so later since the outward sliding of the lateral portions of the vertebra tends to increase the diameter of the spinal canal

Internal Fixation of Depressed Sternal Fracture by Intramedullary Pin Report of Case is presented by John T Lowry[7] (Laredo Tex) Fractures of the sternum as isolated

(7) J Internat. Coll Surgeons 28 661-665 November 1957

injuries are unusual occurring most often as a result of direct trauma Ordinarily little if any treatment is necessary but elevation of the depressed segment may be necessary because of intractable pain an unsightly cosmetic effect or pressure on the thoracic viscera.

The ideal fixation method for a depressed sternal fracture after reduction is relatively simple and requires no unwieldy apparatus It allows early ambulation effectively maintains the fractured bones in their proper position and alinement and does not necessitate a major secondary operation to re

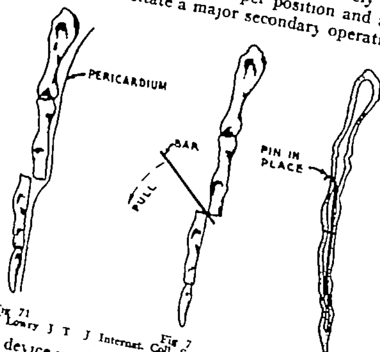


Fig 71 Fig 7 Fig. 73
(Courtesy of Lowry J T J Internat. Coll. Surgeons 28 663-665 November 1957)

move the device used for fixation Intramedullary fixation of a fracture of the body of the sternum by a Rush pin seems to fulfill these criteria.

Man, 42 had been struck on the chest by the steering wheel of a car He was in acute distress. Examination disclosed pronounced depression of the upper half of the sternum. Anteroposterior and lateral x rays of the chest disclosed a fracture of the body of the sternum with about a 3-cm. depression of the lower end of the upper fragment and about 2 cm. overriding of the fragments. With the patient under general endotracheal anesthesia, after preparations for major thoracotomy a midline incision was made over the body of the sternum, with its center at the palpable fracture site (Fig 71) The periosteum was elevated from the body of the sternum for a distance of 10 cm. above and below the site of a transverse fracture. There were no loose fragments A periosteal elevator was introduced between the fragments of the bone and insinuated gently caudad until its point was impinged

on the fractured end of the upper fragment Reduction was then accomplished by manipulation of the periosteal elevator (Fig 72) A 5-in Rush intramedullary pin was chosen and a 3/16-in. hole bored in the anterior cortex of the sternum just below the manubriosternal joint. As the tip of the drill penetrated the anterior cortex the drill, while still being rotated was dropped cephalad until it was parallel with the anterior surface of the sternum The Rush pin was inserted into this opening of the bone and driven across the fracture site (Fig 73) Remarkably rigid fixation of the fracture was noticed as soon as the pin was in place The wound was closed in layers with periosteal sutures of chromic catgut and skin sutures of interrupted cotton. The patient was ambulatory on the next day and was discharged 48 hours after the operation.

Posterior Dislocation of Shoulder is such an infrequent injury that it is often overlooked according to Webster H Brown John M Dennis Charles N Davidson Paul S Rubin and Harold Fulton [8] Lesser degrees of posterior displacement generally described as subacromial are especially rare comprising about 1% of all shoulder dislocations Nerve and vascular complications do not occur often but bone capsule and tendon injuries are relatively common with marked atrophy necrosis and deformity in the later stages of chronic dislocation or recurrence

Results are considered excellent if reduction is accomplished promptly and can be maintained Early detection and prompt reduction are important Otherwise typical grooves (Figs 74 and 75) and finally deformities may develop

The following radiologic projections are useful in diagnosis and may succeed under certain conditions but no one projection is possible under all circumstances or uniformly successful anteroposterior anteroposterior stereoscopic, horizontal shift anteroposterior stereoscopic vertical shift anteroposterior in internal and exterior rotation transthoracic lateral (erect) axial (or lateral) superoinferior or inferosuperior with arm abducted axial view of scapula with central ray tangential to ribs semioblique with affected shoulder against Bucky diaphragm and unaffected houlder rotated 15 or 20 degrees away from Bucky diaphragm and planigraphic studies In addition to more standard views it is suggested that a simple projection be used giving a comparison film of the 2 sides This view exaggerates any abnormality of relationship and can be obtained on comatose and

(8) Radiology 69 815 822 December 1957



Fig 74 (top) —Posterior dislocation, essentially untreated because of cardiac complication, at 3 weeks, with typical anterior groove or notch.
Fig 75 (bottom) —Anteroposterior view showing both anterior and posterior grooves with abnormal relationships confirmed and accentuated in similar simultaneous projection.
(Courtesy of Brown, W H., et al. Radiology 69 815-822, December 1957)

bedridden patients The only essential requirement is that both shoulders be projected in exactly the same position down to and including the hands This view has proved useful in practice

Supracondylar Fractures of Humerus in Children. Charles J Frankel Bennett Caughran and Charles Borzilleri[9] (Univ of Virginia) reviewed the records of 50 children with badly displaced extension type of supracondylar fractures, treated by gentle manipulation under anesthesia (in the ward) repeated injection of hyaluronidase application of Dunlop skin

(9) South M J 51 1523-1528, December 1958.

traction and mild compression bandaging of the arm. In patients with circulatory difficulties skeletal was substituted for skin traction

Over 95% of the children were hospitalized 2-8 hours after the fracture Swelling around the elbow was intense in practically all and many developed blebs

Normal flexion and 175 degrees of extension were achieved in 37 children 6-9 weeks after discharge A normal range of motion was regained by 32 children in 10-13 weeks

Dunlop traction or a slight modification of that method, is considered an effective means of treatment for these fractures End results were excellent better than those with the older method of manipulation and plaster fixation No skeletal traction was needed The use of pins or screws should be reserved for patients with circulatory embarrassment because of the possibility of infection

Postoperative Complications of Fracture Union in Upper Extremity Causes Prevention and Treatment. Carlo Marino Zuco[1] (Rome) lists as the causes of surgical failure in fractures of the upper extremity those related to the type of fracture the method used or postoperative treatment. Failures resulting from the type of fracture include pseudarthrosis due to exposure of the fracture and retention of foreign bodies pseudarthrosis caused by removal of fragments and delay of union or nonunion due to nerve trauma. Failures resulting from the surgical methods used include those due to inadequate fixation of the fracture site rupture of the synthesis and poor tolerance of materials used in synthesis Under postoperative treatment is included ineffective immobilization This may be due to failure to extend the cast far enough to consolidate the fragments removal of part of the cast by the patient too early mobilization of the joint and failure to maintain immobilization long enough to secure union

To avoid these complications the following measures are suggested (1) careful study of the approach to treatment of limbs previously operated on (2) use of tolerable synthetic materials and a small number of them (3) use of synthetic materials that prevent any movement of the fragments even when the surrounding muscles are stimulated to the active function of callus formation (4) suitable preparation of the

(1) J Internat. Coll Surgeons 30 568-574 November 1958.

fragments (restoration of the surfaces opening of the medullary cavity an accurate approach to the fragments) (5) eventual application of grafts and if possible autoplastic ones (6) immobilization for a period suited to the type of fracture method of treatment used and possible coexistence of nerve trauma

Even with pseudarthrosis after an operation it is possible to obtain good consolidation by means of correct treatment.

Closed Reduction of Common Shoulder and Elbow Dislocations without Anesthesia is discussed by Robert W Parvin[2] (US Army Hosp West Point N Y) Acute dislocation of the shoulder and elbow in the young or old male or female and muscular athletic or less well-developed persons may be reduced without anesthesia and without increased pain or trauma.

The commonest method of reduction in shoulder dislocations is that in which the patient is placed prone on a high table or litter with the affected extremity hanging freely over the side (Fig 76) Occasionally after only a few min



Fig. 76.—Reduction of shoulder with dependent traction. Note that scapular portion of shoulder is well over edge of table, resulting in traction in abduction. (Courtesy of Parvin, R. W. A.M.A. Arch. Surg. 75:972-975, December 1957.)

(2) A.M.A. Arch Surg. 75:972-975 December 1957

utes in this position the weight of the arm alone is sufficient force to reduce the shoulder However traction is usually required The operator sits on a low footstool or on the floor grasps the patient s wrist gently but firmly and exerts steady downward traction If reduction is not effected by 5-6 minutes of sustained traction it may be aided by flexing the elbow about 25 degrees and slightly rotating the arm externally with traction maintained While traction is being applied the patient is continually advised to tell the operator whether pain significantly increases If it does the traction is diminished since painful traction results in increased spasm and failure

In Boehler s method the patient is placed on a stool and helped to grasp the leg of a fixed or heavy piece of furniture with the hand of the affected extremity at waist height. After being instructed to take all the time necessary the patient is asked to maintain a firm grip on the leg of the piece of furniture and start rotating his body on the swivel top stool in the opposite direction so that he actually effects external rotation of the arm When it begins to be painful the patient is coached to let up on the rotation a little until he gets used to that position and is then directed to resume rotation At about 70-110 degrees of external rotation spontaneous reduction results This method is not suitable for the emotionally unstable person or for a patient with a labile blood pressure and a tendency to faint It is an excellent method to teach patients with recurrent dislocations so that they may reduce their shoulder dislocations when help is not available or patients who are unable to lie on the abdomen as those in advanced pregnancy

With Bennett s technic the patient is recumbent on a litter or table. The operator flexes the elbow of the affected extremity and places his belt around the forearm just distal to the elbow With the arm moderately abducted at the shoulder the body weight of the operator can be applied in line with the humerus until reduction is accomplished. It must be appreciated that considerable traction force can be obtained and it is believed that this method is not as traumatic as either of the other two

Before reduction unless it is on the athletic field the shoulder is x rayed to rule out fracture. After reduction if the initial dislocation is associated with trauma or if it is a

second or third dislocation associated with severe injury the arm is immobilized in a Lund swath for 3 weeks When dislocation has occurred without trauma only a simple sling is used

Reduction of elbow dislocation consists in placing the patient prone on a high table with the affected extremity hanging freely over the side Gentle downward traction is applied at the wrist for 1 10 minutes Forceful traction results in severe spasm and failure Within 1 or 2 minutes of traction the olecranon will be felt to ride distally on the humerus At this point the operator while maintaining traction at the wrist with one hand gently lifts the humerus laterally to flex the elbow about 20 degrees thus completing reduction Reduction in this fashion is so gentle that frequently the elbow is found to be reduced when the humerus is lifted

X rays are taken before reduction of elbow dislocations to rule out associated fractures After x ray verification of reduction the extremity is immobilized in a posterior splint with the elbow at a right angle and the forearm in neutral position After 3 weeks the posterior plaster splint is removed a simple sling applied and whirlpool and graduated exercise instituted About 6-26 weeks may be required to regain full range of motion of the elbow

Fractures of Elbow Joint New Classification and Roentgenologic Guide to Major Pitfalls of Diagnosis and Treatment. Jacob Kulowski[1] (St Joseph Mo) classifies fractures involving the elbow according to anatomic factors Figure 77 illustrates the approximate confines of the joint capsule and its relation to the neurovascular bundle (brachial artery and median nerve) radial and ulnar nerves and the vaginal (deep or ensheathing) fascia The capsular compartment contains only the articular parts of the humerus radius and ulna and the synovial membrane All other soft structures of importance are outside the capsule. The precise areas of capsular division at the elbow suggest a broad categorization of fractures into intracapsular extracapsular and combined intra and extracapsular groupings

The clinical implications with regard to intracapsular fractures are clearcut With rare exceptions these fractures—with the capsule intact—hold no threat to the neurovascular bundle Exceptions to this rule are dislocations with varying

(1) Am. J Roentgenol 9 69 -696 April, 1958

degrees of capsular tearing Occasionally in these cases some causalgic symptoms result due to stretching of the neurovascular bundle over the smooth rounded lower end of the humerus However intracapsular fractures demand extremely accurate reduction and fixation until adequate healing has taken place to avoid subsequent posttraumatic ar

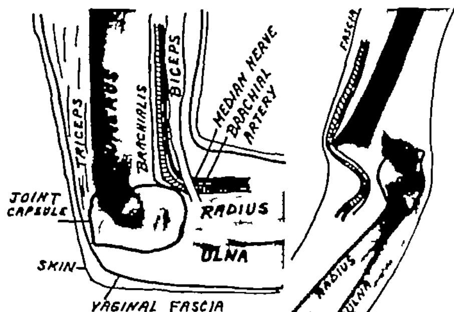


Fig 77 (left) —Approximate interrelations of soft part about elbow Note normally protected position of neurovascular bundle in groove between biceps and brachialis muscles.

Fig 78 (right) —This kind of impingement of neurovascular bundle on lower end of humeral fragment threatens immediate or early integrity of lower arm and hand from ischemia. Obvious laceration of brachialis (note how close to surface lower humeral fragment is anteriorly) leads to subfascial tension from bleeding and edema.

(Courtesy of Kulowski J Am. J Roentgenol. 79-692-696, April, 1958.)

thritis contractures of the joint capsule and synovial membrane *and formation of joint mice* and *other* bony blocks to normal joint movements

All muscles nerves and blood vessels are contained in the fascial compartment of the forearm antecubital and arm areas Any increased subfascial tension (from bleeding edema or both or due to tight bandaging) squeezes the soft structures under the fascia because there is little or no yield to the fascia the tensile strength of which has been determined to be like that of soft steel All extracapsular fractures tend to invade this fascial compartment by hemorrhage *and edema of the soft parts* Moreover certain of these fractures most commonly the supracondylar directly

impinge on the neurovascular bundle (Fig 78) Besides increased subfascial tension and direct impingement of the lower end of the fractured humerus on the neurovascular bundle there is so-called reflex arterial segmental spasm of the brachial artery It is believed that the ultimate degree of ischemic complications depends on the amount of participation by each or all of these mechanisms

In supracondylar fractures the relative closeness of the anterior humeral fragment to the skin (Fig 78) definitely indicates that the brachialis muscle has been lacerated thus exposing the neurovascular bundle to both direct and indirect injury Subfascial distentions will be clearly evident on x rays especially in cases in which the fascia has not been lacerated

► [The most common serious complication of fractures of the elbow is the development of an irreversible Volkmann contracture. This is not, primarily either an ischemia or a paralysis but both conditions are sometimes present. The most typical Volkmann's paralysis has its onset with marked edema, dusky appearance of the skin and severe pain. This occurs when the venous return from the arm has been shut off because of edema in the region of the elbow especially beneath the deep fascia. Acute flexion of the elbow also compresses the veins. The importance of early recognition of impending circulatory necrosis of muscle and other structures in the forearm cannot be overemphasized. Definite treatment carried out while there is still good sensation may prevent extensive damage to the neuromuscular structures with complete functional recovery.—Ed.]

Surgical Treatment of Fractured Proximal Head of Radius is discussed by Horst Cotta[4] (Free Univ Berlin) These fractures may be due to direct or indirect injuries and can be classed as fracture of the proximal head of the radius in children and juveniles chisel fracture with or without dislocation in adults intracapsular transverse fracture complete fracture (splintering of the head) dislocation in children and adults and epiphysiolysis

In the choice of treatment of the fractured proximal head of the radius it is important to distinguish between children and adults In children and juveniles the head is displaced laterally If the fracture heals in malposition or if a gap develops because of destruction of the radial head considerable growth disturbances and limitations in function ensue Thus good restoration is desirable and resection of the head is contraindicated

TECHNIC.—The elbow joint of the stretched arm is brought into the varus position. Pressure of the thumb against the radial head brings it

4) Arch orthop u. Unfall-Chir 50 _ 60-268 1958

into correct position Bohler has suggested use of a Steinmann nail to secure the radial head in position This is followed by fixation in an upper arm plaster cast for 3 weeks

In severe injuries where the head slides off the radius completely open reduction may be required If small bone fragments are sheared off they can be fixed either by per cutaneous wiring or with autoplastic bone grafts In a major lateral dislocation wedge shaped bone grafts may help to keep the head in position A thin Kirschner wire can be driven through the head into the shaft and left there for about 3 weeks or the head may be fixed by the transar ticular method of Witt.

Chisel fracture occurs only in adults With minor dis placement an upper arm plaster cast for 3 weeks with the joints in mid position will suffice. If the fragment is large and involves the major part of the articular surface with lateral displacement surgical reconstruction by wiring is indicated If the radial head is splintered it is removed.

When isolated dislocation of the proximal head of the ra dius occurs in children it is usually associated with a frac ture of the ulna The anterior dislocation is the commonest type in adults Inveterate dislocations are often seen. Re position in these is very difficult if not impossible so resec tion of the head is the treatment of choice In relatively fresh dislocations surgical reposition and reconstruction of the ring band are possible

Epiphysiolysis occurs only in children and is usually in complete Treatment depends on the age of the process. In fresh fractures reposition by manipulation is usually feasi ble Older fractures generally require surgical reposition.

Intramedullary Fixation of Fractures of Forearm. Frac tures of the shafts of the forearm bones can be satisfactorily treated by closed manipulation provided both axial and ro tational alinement is procured and maintained In 25 cases which could not be so managed F Wayne Lee[5] (Charlotte N C) employed internal fixation using a Rush pin in the ulna and a Rush pin or a large caliber Kirschner wire in the radius (Fig 79) In most cases manipulation under anes thesia with immobilization by cast was the primary method of treatment. A direct approach was made to the fragments through standard incisions Retrograde cannulation of the medullary canal was used for the ulna In addition to di

(5) South. M J 51 350 357 March 1958

rect visualization of the radial fragments the radial styloid was exposed through a small transverse incision The wire or pin was inserted through a drill hole placed as near parallel to the shaft as possible

Since union is often delayed after this type of fixation use



Fig 79 —Fracture fixation with Rush pin in ulna and large wire in radius. (Courtesy of Lee, F W South. M J 51,350-357 March, 1958.)

of accessory bone to reinforce the fracture site is recommended as well as cast immobilization which should be continued until solid union is shown by x ray examination Premature removal of the pins is hazardous Fixation must be rigid and can be assured by proper choice of pins which may be bent to gain physiologic and anatomic advantage. Sometimes internal intramedullary fixation in only one bone is adequate. Such fixation gains length and aids in aligning the unpinned bone

Firm union did not occur in any patient before 14 weeks. There were no wound infections Postoperative range of motion could not always be adequately measured because of other complicating injury about the wrist or elbow However where it could be evaluated it approached normal.

► [I can find only one area of disagreement with Lee. For more than 20 years I have advocated and used osteoperiosteal bone grafts to promote more rapid healing of any fracture treated by open reduction. Intramedullary rod plus plaster cast immobilization is ideal for treating fractures of the forearm. This permits physiologic compression between the fracture surfaces which Eggers Charnley and many other have proved to be so important in obtaining a high incidence of fracture union. But this is not rigid fixation. Rigid fixation is neither necessary nor desirable. Rigid fixation (such as by the Lane plate) prevents continued physiologic compression between fracture surfaces The remarkable success of the hanging cast for the treatment of fractures of the shaft of the humerus should be adequate proof that rigid immobilization is not necessary It is frequently a primary cause of nonunion As absorption of the fracture surfaces takes place they are kept apart by rigid fixation and this promotes delayed union or nonunion —Ed.]

Colles Fractures Classification and Treatment. Edwin O Geckeler and Daniel J Gross[6] (Hahnemann Med College) point out that in the simple classic type of Colles fracture only the radius is fractured with no damage to the wrist joint. The true Colles fracture, which is relatively stable, comprises only about 12% of wrist injuries In complicated fractures the *distal end of the radius* is comminuted with shortening because the cancellous bone structure has been crushed and impacted In many instances there is damage to the radioulnar ligament and the triangular ligament, with an avulsion fracture of the ulnar styloid and a lateral shift at the wrist joint This form comprises about 88% of wrist fractures and correction is difficult (Fig 80)

It is impossible to reduce most comminuted fractures by manipulation or to maintain reduction with an ordinary splint or cast. Traction must be applied and the shaft of the bone and its articular end held apart until the gap has become filled in with solid new bone The simplest and best treatment is traction and a transfixion cast

METHOD.—Most patients are given general anesthesia. Displacement of the fragments is reduced and the length of the radius is restored by continuous traction. This traction made on the thumb only (Fig 81) corrects lateral shifting at the wrist joint and replaces the ulnar styloid when it is fractured. The skin is cleansed only after traction has been applied, when it is given a 10-minute preparation. While arm is in traction a Kirschner wire is inserted through the

(6) Pennsylvania M J 61 486 488 April, 1958



Fig 80 (above) —Average so-called Colles fracture (retouched) not the classic type.

Fig 81 (right) —Traction in frame using Caldwell finger trap on thumb only Kirschner wires are inserted while arm is in traction, then padded plaster cast is applied for transfixion.

(Courtesy of Geckeler E. O., and Gross D J Pennsylvania M. J 61 486-488 April, 1958)



Fig 82.—Previously untreated fracture (retouched) in which shortening of radius reversed normal interstyloid line after reduction by traction. Normal length of radius and interstyloid line is restored and dorsal displacement corrected, but gap from damage to cancellous bone structure must be maintained during repair (Courtesy of Geckeler E. O., and Gross, D J)

metacarpal of the thumb and another through the proximal shaft of the ulna then plaster is applied including the wires, as a transfixion cast Any posterior displacement of the fragments can be corrected by flattening the cast as it hardens Because of the extensive damage and the tendency of the fragments to become redisplaced, the cast must be worn until solid union occurs (Fig 82) for at least 8 weeks. The wires are then removed and a light anterior splint is applied for 2 more weeks.

Examination of x ray films of 50 unselected wrist fractures treated by this method revealed that shortening of the radius had been completely corrected in 64% whereas slight shortening was present in the rest. Dorsal tilt and lateral shift were entirely corrected in 74% Final functional and anatomic results were satisfactory except in 2 cases in which infection occurred around the Kirschner wires. The infection subsided after the wires were removed but the fragments became redisplaced with consequent permanent deformity

► [My associates and I have used the technic demonstrated and recommended by Geckeler and Gross for about 10 years. We have found it to be the most satisfactory method of treating complicated unstable Colles fractures.—Ed.]

Fractures of Distal Radius and Ulna and Dislocation of **Proximal Carpals** are discussed by C L. Hinkel[7] (Danville Pa) Despite all precautions one may fail to demonstrate a clinically suspected abnormality by x rays In such cases it is wise to treat the wrist as though it were fractured and to reexamine it in 7 10 days This applies not only to scaphoid injuries but also to injuries of the bones and epiphyses of the forearm

Occasionally sesamoid like accessory ossicles are found in the wrist and one must differentiate between accessory bone and fracture. More than 20 carpal accessories have been described Double ulnar styloid centers have been described but are not readily confused with fractures Double ossification centers seldom occur in the wrist They may lead to the production of bipartite carpal bones simulating fractures. Although some double bones are unquestionably congenital, most of the double scaphoids probably result from unrecognized fractures In some cases it is impossible to differentiate between these two conditions However old ununited fragments from the ulnar styloid may simulate congenitally separate ossicles Fragments avulsed from the ulnar styloid frequently remain ununited and in children these often grow to

(7) Radiology 69 809 814 December 1957

become smoothly rounded resembling accessory centers of ossification Any of the carpal bones may become dislocated with or without fracture Recurrent dislocations of the scaphoid have been described

One must observe the lunate and determine its relations to the capitate and radius in every wrist which has been subjected to trauma The relation of the head of the capitate to the notch of the lunate and of the lunate to the radius is best evaluated in the lateral view Any deviation from normal is a reliable indication of dislocation which is of two general types (1) In isolated dislocation of the lunate direction of force causes it to rotate so that its notch faces the palm and does not receive the head of the capitate. The lunate is of course displaced slightly toward the palm whereas the capitate slides dorsally This dislocation is contingent on avulsion of the dorsal radiocarpal ligament. (2) In retrolunar dislocation of the carpus the lunate remains in position with respect to the radius but the capitate is displaced out of the lunate notch and toward the dorsum of the wrist carrying



Fig. 83 —Lateral view of wrist showing retrolunar dislocation of carpus. (Courtesy of Hinkel, C L. Radiology 69 809-814 December 1957.)

all the other carpals with it (Fig 83) Fracture of the scaphoid or another carpal bone may complicate the dislocation and unless care is exercised the fracture may distract attention from the dislocation

Epiphysial separations with displacement are essentially fractures through the distal metaphysis Even when the x ray appearance suggests fracture through the cartilage, the line of cleavage is on the metaphysial side of the epiphysial plate and fragments of trabeculae are displaced along with the epiphysis Restitution of alinement is readily accomplished Since vascularity is excellent and the cartilage columns are not seriously disturbed there is seldom any deformity or inhibition of growth

A more serious injury to the growing cartilage may result from a fall on the dorsiflexed wrist without gross displacement or recognizable fracture This injury consists in crushing of the epiphysial cartilage. The x ray manifestations may be minimal or absent but follow up studies over a period of years often disclose premature fusion.

Use of Small Bone Screws in Treatment of Metacarpal, Metatarsal and Phalangeal Fractures was tried by Burton C Kilbourne and Eudell G Paul[8] (Chicago) in 14 fractures, a metacarpal plate was used twice. The screws have 36 threads/in The root diameter of the screw is 0 054 in and the thread diameter is 0 090 in The screw can be passed through a no 42 (0 093 in) drill hole without engaging and holds well in a no 47 (0 081 in) or no 48 (0 078 in) drill hole in cortical bone This screw so inserted will not strip out easily with moderate pressure on the screwdriver

TECHNIC —The metacarpal fracture is exposed in a bloodless field through a vertical incision placed to one side of the metacarpal on the dorsum of the hand. When two metacarpals are to be exposed, a single skin incision between the two will be adequate. The incision is deepened down to and through the periosteum, disturbing the extensor tendons as little as possible. With a small dissector the periosteum and interossei dorsales attachments are reflected sufficiently to allow reduction of the fracture and introduction of suitable forceps or bone clamp The direction of the proposed drill hole is noted while the fracture is held in reduction. A no 42 drill is used through the proximal side of the cortex and no 47 or 48 through the opposite side of the cortex. To start the drill in the line selected, it may be necessary to gouge a small notch in the cortex to prevent the drill from slipping. The hole through the opposite side of the cortex must be accurately alined with the proximal drill hole or reduction will be compromised.

(8) J Bone & Joint Surg 40 A 375 383 April, 1958.

In dealing with a short oblique fracture near the head of the metacarpal it may be necessary to mark the opposite side of the cortex with the drill while the fracture is reduced, then displace the superficial fragment and hold the deeper fragment more firmly while drilling is completed. If the fracture is long oblique or spiral a bone-holding clamp or a small Kocher forceps may be of great help. A countersinking instrument will provide a recess for the screw head when the screw is inserted in oblique direction. The Bunnell hand drill or any similar twist drill that will bring the operator close enough for



Fig 84 —X rays of oblique fracture of right 5th metacarpal in man, 29 Fracture was reduced and hand put in cast elsewhere 1 week previously reduction was not maintained. (*A*) Treatment by open reduction and transfixion screw led to union in anatomic position (B) (Courtesy of Kilbourne, B. C., and Paul, E. G : J Bone & Joint Surg 40-A 375-383 April, 1958.)

accurate control is satisfactory The screw should extend completely through the far side of the cortex, but protrusion beyond 1/32 in. is to be avoided.

Wound closure is carried out by use of fine cotton (no 60 or 100) to the subcutaneous layers and fine Dermalon to the skin. The corresponding digit is then immobilized on a light aluminum splint in relaxed, semiflexed position. Splinting is maintained for 2-4 weeks depending on the stability of fixation as judged at operation. Active use of the finger is encouraged but passive stretching and heavy work are avoided until progress toward union is deemed sufficient by x ray evidence.

Use of the single transfixion screw in oblique or spiral dis

placed fractures of the metacarpals and of the important 1st metatarsal bones led to very satisfactory results The reductions were anatomic bone healing progressed satisfactorily and functional results were very good (Fig 84 *A* and *B*) Use of transfixion screws in the fingers should probably be limited to the proximal phalanges and even in this area to the oblique displaced fracture near the base which is difficult to control by other methods

Management of Posterior Dislocation of Hip Complicated by Fracture Dislocation of Acetabular Rim and Primary or Secondary Paralysis of Sciatic Nerve is described by Henry W Meyerding[9] (Rochester Minn) The most favorable functional result in posterior dislocation of the hip complicated by fracture-dislocation of the acetabular rim and involvement of the sciatic nerve is obtained by early accurate diagnosis with reduction of the dislocated hip replacement of large bone fragments removal of small fragments and inspection and replacement or repair of the stretched or torn sciatic nerve When the patient s condition permits and there is no indication of damage to the sciatic nerve manual reduction done with the aid of general anesthesia is the usual treatment X rays of the pelvis before and after manipulation or operation in the anteroposterior view and at an oblique angle are advisable and should be repeated over 2 3 years to detect evidence of aseptic necrosis Bone fragments may not be recognized in the emergency x rays and may produce primary and secondary sciatic paralysis Intra acetabular fragments may prevent proper reduction of the dislocation

Early open operation to reduce the hip removal or replacement of bone fragments and inspection and release of displacement of pressure on or repair of the sciatic nerve constitute the most efficient method of treatment and offer the most favorable prognosis When weeks or months elapse after the injury and nerve involvement the most skilful surgical treatment cannot assure return of nerve function Osteoarthritis and aseptic necrosis may result despite the most expert care and may require cup arthroplasty or hip prosthesis The problems involved are illustrated in the following case.

Man 39 could not move his hip after a car accident. Skin traction had been applied then pin traction through the distal end of the femur

(9) J Internat Coll Surgeons 28 654 662, November 1957

The pin wounds became infected and the pin was removed. He was permitted to be up and about on crutches. The pain inability to bear weight, deformity disability and footdrop had caused him to seek further consultation 10 weeks after the accident. The left leg had shortened and was internally rotated it was causing much pain There were two holes in the skin above the right knee and pus was drain



Fig 85 —X-ray 39 days after accident, showing posterior dislocation of hip and large fragment of posterior-inferior rim of acetabulum displaced upward and backward. Patient had primary sciatic paralysis. (Courtesy of Meyerding H. W : J Internat. Coll. Surgeons 28 654-662 November 1957)

ing from the hole on the inner aspect. Tenderness was evident along the course of the left sciatic nerve and greater trochanter Footdrop was noted. X rays disclosed upward and posterior dislocation of the left femoral head one large fragment of the left acetabular rim had dislocated upward and backward, and several small bone fragments were disclosed (Fig 85)

A posterior oblique incision, separating the gluteus maximus fibers just above the pyriformis muscle was extended from the rim of the ileum to the posterior-superior angle of the greater trochanter Re

traction made possible palpation of a firm mass which represented the dislocated femoral head and a large bone fragment broken off from the posterior inferior rim of the acetabulum and displaced upward. The sciatic nerve was stretched over a sharp edge of this fragment (Fig 86) and showed pronounced atrophy in the outer branch. The displaced bone fragment 1½ in wide and 1 in. thick, was excised which released pressure on the nerve. The femoral head was caught in dense scar tissue this tissue was excised Attempts to reduce the head of the femur by manipulation and use of bone skid were unsuccessful A second attempt 7 days later to reduce the hip by

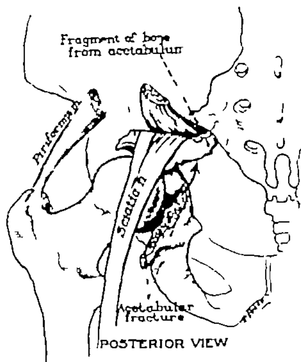


Fig 86.—Fracture of posterior-inferior rim of acetabulum, with large bone fragment displaced backward and upward, and posterior dislocation of hip. Components of sciatic nerve were stretched over sharp edge of displaced bone fragment. (Courtesy of Meyerding H W J Internat. Coll. Surgeons 28:654-662, November 195[illegible])

manipulation also was unsuccessful Hence a Kirschner wire was placed through the upper end of the left tibia and longitudinal and lateral tr[illegible] applied by a sling on the 46th day after the injury

The patie[illegible] withstood the traction well On the 21st day after it had been appl[illegible] he felt a sudden snap in the hip and found that he could rotate [illegible] hip He also had less pain. Examination clinically confirmed red[illegible]ion of the hip reduction also was evident by x rays. The Kirschner [illegible]re wa[illegible] removed and a plaster of paris spica cast was applied that ex[illegible]nded t[illegible] the toes with the foot held at right angles.

After 2½ months he w[illegible] discharged wearing a spica cast. When the cast was removed 5 m[illegible]nths later x rays showed the femoral head in the acetabulum The h[illegible] h[illegible]d about 80% normal motion, but foot



Fig. 87.—X-ray 14 months after fracture dislocation, showing hip reduced. (Courtesy of Meyerding H. W : J Internat. Coll. Surgeons 28:654-662, November 195)

drop persisted. The patient returned 14 months after operation wearing a right angle brace to control the footdrop X rays revealed the hip reduction to be satisfactory (Fig 87) He had an ulcer of the lower left leg as a result of a burn and he was getting about on crutches. At the end of a 3½ year follow up, he was still using crutches and still had the footdrop

Central Fractures of Acetabulum are discussed by Robert A Knight and Hugh Smith[1] (Univ of Tennessee) A review of the Campbell Clinic records of acetabulum fractures including follow up studies of some patients for 10-20 or more years suggests that reasonable effort to restore a congruous acetabulum is worth while except in elderly obese or other-

(1) J Bone & Joint Surg 40-A 1 16 January 1958

wise poor risk patients The comminution and displacement of fragments even of the acetabulum itself may indicate to the surgeon that the end result cannot be anatomic restoration However if the weight bearing vault of the acetabulum can be re-established in the normal relation to the femoral head the risk to the patient is justified. Stereoscopic



Fig. 88.—Horizontal central fracture of acetabulum, with medial displacement of femoral head under acetabular vault Not double-dome deformity and trochanteric fracture. (Courtesy of Knight R. A. and Smith H J Bone & Joint Surg 40-A 1 16, January 1958)

anteroposterior x rays are essential to correct interpretation of the fracture and to correct approach

The authors experience in the open reduction and internal fixation of acetabulum fractures began in 1949

Man 19 had multiple fractures of the pelvis (Fig 88) and ipsilateral fractures of the trochanteric region, shaft and condyles of the femur which precluded the usual methods of traction. The acetabular deformity was so severe that joint function would be poor and unless the acetabulum were restored, degenerative changes would develop later Accordingly 16 days after injury the fracture was exposed through a complete Smith Petersen iliofemoral approach. The operation, including exposure of the fracture, was difficult, and it was almost impossible to close the fracture. Finally a Knowles pin was introduced into each fragment, one on either side of the fracture (Fig

89) These two pins were then grasped by a bone holding forceps and the acetabular fragments were forced into near anatomic position (Fig 90) The patient recovered completely with no hip disability

Perfect restoration of a fractured acetabulum is often impossible since only one limb of the fracture is usually exposed The primary objective is reduction and fixation of the fractures which involve the weight bearing vault (10-3 on the clock) Reduction of the defect of the vault is often difficult, for the fracture may be greenstick, the fragments may overlap or loose bits of bone may lie between displaced fragments Other mechanical obstructions to reduction may exist in the opposite or unexposed areas If a restored acetabular segment remains displaced medially and if the acetabulum is congruous the hip can still function excellently However if the symmetry of the pelvis can be improved or restored all the better Otherwise the limbs may be unequal in length and in women childbirth may be made difficult if the distortion of the true pelvis is severe.

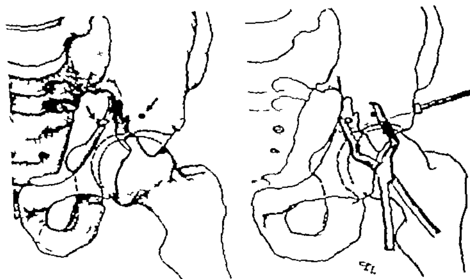


Fig 89 (left) —*Displaced acetabular fracture showing method of inserting Knowles pins into ilium on either side of fracture.*
Fig 90 (right) —*Fracture reduced by gripping Knowles pins with bone-holding forceps. One Knowles pin has been inserted across fracture.*
(Courtesy of Knight, R. L., and Smith, H. J Bone & Joint Surg 40-A:1 16 January 1958)

The type of fracture and the approach through which reduction can be most effectively done must be determined preoperatively In a horizontal fracture the defect should be closed through an anterior approach. The anterior iliofemo

ral approach which Smith Petersen developed for mold arthroplasty affords a satisfactory exposure of such fractures The iliacus muscle is elevated from the inner surface of the ilium and if necessary, the psoas tendon is divided The gluteal muscles are stripped from the outer surface of the ilium enough to expose the ilium above and anterior to the acetabulum permitting insertion of the transfixing Knowles pins or screws The fracture cannot be drawn into final position by the lag effect of the threaded pin or screw Rather it must first be reduced and then fixed

Pins and screws must traverse the cortex on both sides of the fracture Threads engaging only the cancellous bone of the pelvis may not hold for there is considerable tension on the fixative agents after reduction If in addition the posterior wall of the acetabulum is comminuted and there is danger of redislocation or subluxation a transfixing Steinmann pin may be drilled through the greater trochanter above the level of the femoral neck and into the ilium just above the acetabulum Immobilization in a body cast or skeletal traction is maintained for 6-8 weeks Weight bearing is permitted after 10-12 weeks

For vertical (12-6) fractures the defect of the apex of the acetabulum should be reduced and fixed through a posterolateral approach. Should the fracture extend vertically from the acetabulum up toward or even through the iliac crest, it may be necessary to extend the subperiosteal dissection of the gluteal muscles sufficiently to permit adequate exposure of the proximal limb of the fracture If the fracture extends farther upward and then backward toward the sacroiliac joint or the greater sciatic notch posterior dissection will be required.

The vertical type of fracture is harder to reduce than the horizontal because it is so deeply situated within the incision and because the smooth relatively flat surfaces of the fragments cannot be grasped by ordinary bone-holding instruments Knowles pins drilled into the fragments can be used to manipulate them up into position When the depth of the fracture does not permit the use of transfixion screws staples or slotted plates and screws are inserted into the thick bone above the acetabulum When the deforming force is considerable use of the slotted plate also permits impaction of the fracture just before the screws are finally tightened If

there is an additional posterior acetabular fragment, it may be fixed in place with screws, as it would be in an ordinary posterior fracture dislocation

It is not usually necessary to incise the capsule of the hip joint to be certain that the acetabular fracture is accurately reduced In horizontal fractures, the capsule may be opened if it is feared that a fragment of bone is lying free in the joint otherwise the anatomic reduction of the fracture at the ilio pectineal line is sufficient evidence that congruity of the joint has been restored In vertical fractures the glenoid labrum may be dissected from the superior margin of the acetabulum for a short distance on either side of the fracture so that the bone edges may be visibly matched

With open reduction after-care is simplified and morbidity greatly diminished Results to date are generally superior to those obtained by the older methods of manipulation and traction.

► [A notable advance in the treatment of fractures of the pelvis has been recorded by several surgeons who have reported that open reduction of some of these fractures is indicated. The results reported by Knight and Smith, who used open reduction and internal fixation, show the advantages of this method in selected cases —Ed.]

Primary Replacement with Metallic Intramedullary Prosthesis in Fresh Displaced Fractures of Surgical Neck of Femur The following technic for replacing a recently fractured femoral head with a metal prosthesis is suggested by F Dixon Conlin[2] (Univ of Arkansas)

METHOD —Under spinal anesthesia with the patient laterally recumbent and the broken hip uppermost and flexed, a curved incision is made through the fascia lata to expose the posterior superior portion of the trochanter The obturator internus and gamelli are divided, a suture placed in them and they are used to retract and protect the sciatic nerve. A linear incision is made in the capsule and its edges held open by retention sutures The thigh is then internally rotated to expose the fracture site. The head is removed with a cork screw perhaps assisted by a Smith Petersen gouge inserted into the incisura acetabulae to break cohesion between head and acetabulum. The size of the head determines selection of the proper prosthesis. The Fred Thompson vitallium prosthesis has been used routinely The femoral heads are saved for the bone bank.

A suitably bent, sharp ⅛ in. uterine curet is useful for reaming out the medullary canal to receive the prosthesis. Rongeurs are used to nibble off the neck until the base of the prosthesis fits accurately The prosthesis is removed and replaced several times if necessary so that the normal length of head and neck and the normal degree of anteversion are restored. If the neck is too long the iliofemoral liga

(2) Am. Surgeon 24 93-97 January 1958.

ment and capsule will be excessively taut this will limit hip extension and abduction. If the neck is too short, the prosthesis will not sit well on the calcar and the gluteus medius and minimus will be at a disadvantage Further the likelihood of subluxation or dislocation is increased if the neck is too short and the prosthesis not impacted into the acetabulum by pull of the musculature and caspule.

After being seated in the femur the prosthesis is reduced into the acetabulum (*Fig 91*) by making traction in flexion and by thumb



Fig 91—Prosthesis in position. Small piece of bone was inadvertently left behind the neck superiorly (Courtesy of Conlin, F D Am. Surgeon *24 93 97 January 1958*)

pressure a skid is sometimes used to prevent interposition of soft tissues With the anterior or anterolateral approach considerable force is often necessary to reduce the head into the acetabulum. Repositioning the head appears easier with the posterior than with the anterior approach. The posterior approach incurs minimal bleeding making transfusion unnecessary except for patients with pre-existing anemia. After operation, a position of flexion and adduction is avoided because of the posterior capsule incision, but patients are ambulant as soon as they are able. This is often the 1st day particularly when there has been only a short interval between fracture and replacement.

Of 23 patients who underwent the above procedure 16

were followed up of these, 12 had excellent results with virtually asymptomatic hips and no restriction of activities.

► [This procedure is the most logical treatment of subcapital fractures in the elderly or mentally incompetent patient and also for pathologic fractures secondary to neoplastic invasion of the neck or head of the femur —Ed.]

Femoral Neck Fractures in Childhood, discussed by H R Mattner[3] (Martin Luther Univ Halle Wittenberg, Germany), may occur after severe accidents such as a fall from a great height or from a horse or a car accident True fractures (not the epiphysiolyses) of the femoral neck usually



Fig. 92 (left.—Medial femoral neck fracture in girl, 8 due to fall from hay barn. Fig. 93 (right) —Same patient 10 months after nailing 15 months after accident, showing wide pseudoarthrotic fissure and aseptic necrosis of entire femoral head. (Courtesy of Mattner H R.: Arch. orthop u Unfall Chir 49 4 3-479 1958.)

affect the lateral areas (cervicotrochanteric or basocervical fractures of Delbet) The same problems are encountered as in similar fractures in adults and concern positioning retention and possible complications such as pseudoarthrosis formation and necrosis of the head The former complication is rather frequent Fast healing which would be expected in the juvenile organism is not always the case Necrosis of the head is not necessarily due to the method of treatment such as nailing Its development depends on whether or not the injury cut off the blood supply

In treatment use of the Whitman plaster in abduction and internal rotation is not sufficient since it may lead to coxa

(3) Arch. orthop. u. Unfall Chir 49 473-479 1958.

vara formation Neither does extension alone give good results Carrell and Carrell have suggested treating the more common peritrochanteric fractures by fixation in a cast in abduction and extension In the less common medial fractures nailing may be advisable Despite exact positioning and immobilization aseptic bone necrosis may still develop



Fig 94 (left) —Twenty-seven months after nailing fracture fissure still not organized, distal end of femoral head cloudy of calcific density, head unrounded; articular fissure, especially in cranial part, almost disappeared. Clinical examination showed complete stiffening in adduction position.

Fig 95 (right) —Six months after subtrochanteric osteotomy over Küntscher nail (3½ years after accident) femoral neck angle straightened; fracture fissure disappeared normalization of bony structure in femoral head, which is still unrounded articular fissure well visualized; heteroplastic bone graft still visible. Clinical examination showed return of moderate motility especially flexion and extension.

(Courtesy of Mattner H. R. Arch. orthop. u. Unfall Chir 49 473-479 1958.)

To prevent it healing should be followed by a long period without weight bearing Mattner suggests the wearing of a Thomas brace for about 2 years

Some of the difficulties in management of these fractures are depicted in Figures 92 95

Five-Year Inpatient Study of Fractured Hips was conducted by Paul M Beegel[4] (Central Maine Gen'l Hosp., Lewiston) on 133 hips Average age of the patients was 83 Over all morbidity due to infections was 2.26% over all mortality 15% When patients were treated by operation mortality dropped to 13% when they were treated conservatively the death rate rose to 20 6% Conservative treatment such as balanced traction Buck s traction spica or bed rest,

(4) J Maine M A. 49 86-90 March, 1958.

was applied in 29 patients. As therapy became more conservative the mortality rose almost in direct proportion. All the infections occurred when the Smith Petersen nail and attached plate were used. Insertion of a prosthesis carried a mortality rate of 17.6%. Most deaths were due to bronchopneumonia; its incidence was equal in operative and non-operative patients.

Prosthesis operation was performed on 29 patients. About 60% of the prostheses were used for treatment of fresh fractures. It is questionable whether use of these prostheses always is wise, since complicating factors appear to be present in the handling of such appliances. It should be remembered that primarily this item is a replacement for an injured or destroyed hip where the situation does not warrant another kind of surgery. It can perhaps reduce worse complications. Thus the surgeon must choose the lesser of two evils. The rate of complicating factors was 58.8% in the author's series. Two dislocations occurred, both in patients in whom anterior approaches were used. Of 7 fractures which were encountered, most occurred with the Eichter prosthesis. It is felt that the hip prosthesis, regardless of type, is merely a substitute to be used in highly specialized instances.

It should be remembered that the fractured hip is only a part, albeit a problem part, of the patient. The patient is actually the problem as such and frequently needs more attention and care than the hip. Because of his usually advanced age he often has many medical complaints which may need care pre- and/or postoperatively. This medical care should be given in co-operation with the surgeon, thus obviating or reducing many complicating factors.

► [This study of the results of treatment during hospitalization, al[illegible] not an end result study, is nevertheless significant. The author has [illegible] sized the importance of treating the patient rather than merely [illegible] the fracture.—Ed.]

Treatment of Fresh Fractures of Neck of Femur [illegible] **Intramedullary Stem Prostheses.** Americo A. Sava[illegible] A. Sage and Vincent Zecchino[5] (Providence, R. I.) [illegible] size that in routine hip fractures successful [illegible] more desirable and gives a better end result tha[illegible] placement prosthesis. In certain selected ca[illegible] a re- tures hip nailing by the conventional meth[illegible] culated risk as far as undesirable [illegible]

(5) A.M.A. Arch. Su[illegible]

The authors treated 44 women and 1 man with over all age of 78 38 who had fresh femoral neck fractures by inserting an endoprosthesis Of the 45 patients 28 sustained fractures of the left hip and 17 fractures of the right hip The type of fracture was subcapital without impaction in 33 and of the midneck type in 12 The operation was done 2 18 days after the injury by the posterolateral approach as used by Austin Moore In all the patients a Moore self locking Vitallium intramedullary stem prosthesis was used. This type of prosthesis preserves neck length and is less apt to become angulated than many other types less likely to become loose with bone absorption and less apt to break After surgery most patients were able to take care of themselves in their homes using a cane as an aid

The advantages of the operation as a primary procedure include early ambulation reduction of hospital stay reduction in cost of the injury fewer complications and easier nursing care

► [Careful selection of cases and accurate fitting of the prosthesis may be expected to give good to excellent results Replacement of the femoral head with an intramedullary stem prosthesis is indicated for treatment of recent subcapital fractures in patients who are mentally incompetent or aged and feeble.—Ed.]

Twenty Year Mortality Statistics on Fractured Hips. Robert Wedeen Herbert Rosenthal and Paul Miller[6] reviewed all fractured hips treated at their hospital during 1936-55 The fractures occurred in 728 women and 210 men Femoral neck fractures (577) were more common than intertrochanteric fractures (361) Although 10 5% of the patients in the entire series died in the hospital mortality decreased over this period from 12 to 9% There was a higher mortality rate among patients with intertrochanteric fractures because they were older The decline in mortality was directly related to decrease in intertrochanteric fracture mortality through better general medical care.

Early in the series most patients were treated by spica immobilization Operative treatment then increased and later in the series it predominated. The percentage of patients treated by traction remained constant throughout. Mortality was 6% among 160 patients treated by spica, 9% among 601 who underwent surgery and 20% among 164 treated by traction The low mortality with the spica method

(6) Bull. Hosp. Joint Dis. 18 86-97 April, 1957

was probably due to the younger age of the patients treated Patients over age 80 had a lower mortality when operative methods were used

In order of incidence, causes of deaths were pulmonary infarcts 30% cardiac conditions 25% pneumonia 20% and cerebral vascular accidents uremia septicemia etc 25% Autopsies in 20 patients revealed death was due to pulmonary emboli in 10 and to pneumonia in 5

Is Conservative Treatment of Pertrochanteric Fractures Still Advisable? H Meyer[7] (City Hosp, Berlin) reviewed results of treatment in 82 patients with pertrochanteric fracture Most patients were between 60 and 83 though 3 were much younger Average age was 72 3 years About a third of the patients had partial or complete wedging The types of treatment used were simple positioning between sandbags 17 patients Braun splint 9 Volkmann splint 22 and extension in Braun splint 34

There were 22 deaths (26.8%) The mortality rate did not seem to be related to the length of time the patient was immobilized Of the patients who died 17 were poor surgical risks. Permission for autopsy on 2 was refused and 1 died of fat embolism, 3 of cerebrovascular accident and 11 of pulmonary complications Among 5 patients transferred to hospitals elsewhere the cause of death could not be ascertained

The surviving patients had the following complications thrombosis in 5 peroneal paresis in 4 pneumonia in 3 wire infection in 3 decubitus ulcers in 1 and pleurisy in 1

Results of treatment were good to excellent (the patients were able to walk freely) in 16 fair to good (moderate restriction in motion) in 30 and unsatisfactory in 8 patients

Because pertrochanteric fractures have a tendency to heal well and are prevalent in the aged, the author prefers conservative to surgical treatment. He believes that surgery would not have improved the mortality or morbidity rate in the present series

Open versus Closed Methods in Treating Fractures of Leg Preston A. Wade and Rolla D Campbell Jr.,[8] reviewed data on 165 fractures of the tibial shaft (38 in children) from the files of the combined fracture service of the New York Hospital and the Hospital for Special Surgery and on 111 similar

(7) Chirurg 29 515-519, November, 1958.
(8) Am. J Surg. 95:599-616, April, 1958.

civilian type fractures from the files of Valley Forge Army Hospital Results of treatment of closed and open fractures by internal fixation were similar in the New York Special Surgery series except with the use of nails when open fractures healed faster In contrast at the Army Hospital open *fractures healed slower than closed ones regardless of the* method of treatment In both groups however closed fractures treated with casts alone healed quicker than open fractures similarly managed

There was little relative difference in the healing time of tibial shaft fractures according to the various methods of treatment used Proper choice of the best method of treatment for each fracture comes with experience for there are many ways to treat fractures of the leg and each method has its place

Of 238 fractures of the leg in adults 21 (8.8%) failed to unite The only method free from serious complications was the use of casts for closed fractures There were no nonunions from use of screws or traction in open fractures nor from use of Lottes nails in closed and open injuries The highest incidence of complications (25%) resulted from use of plates Among the open fractures treated by this method, the incidence of nonunion was 47%

The authors conclude that good results can be expected from the treatment of most fractures of the leg in children by cast methods alone If the fracture in the adult is closed and stable there is little excuse for open reduction and internal fixation It is wise to use the minimum of foreign body internal fixation and to rely on casts for bulk support of the leg when open reduction must be done Thus a minimum of further dissection of bone fragments already in jeopardy of inadequate blood supply is necessary Screws and bands are useful for oblique spiral and large sturdy butterfly fragments Screws have been well tolerated also in open fractures For unstable segmental fractures of the middle third of the shaft the Lottes nail gives excellent results Plates should be reserved for unstable short oblique or small butterfly fractures at either end of the middle third Extensive comminution of the fracture site should discourage application of internal fixation Unmanageable patients may occasionally need double Kirschner wire transfixation of the tibia below and above the fracture site and a long leg cast

when comminution is too severe for other methods of treatment. If there is obvious clinical free motion at the fracture site in noncomminuted fractures of the tibia at 4 months or in comminuted fractures at 6 months in the absence of infection autogenous bone-grafting should be done and if possible better internal fixation applied.

Arterial Injuries Leading to Gangrene as Complications of Fractures of Lower Extremities Report of Seven Cases. According to reports in the literature traumatic arterial injury can be classified as follows (1) arterial contusion and ensuing vasospasm (2) thrombosis in the area of the injury or embolism on its distal side originating from arterial contusion and intimal lesion and (3) rupture of an artery

Erkki V S Koskinen[9] (Maria Hosp Helsinki) observed



Fig. 96.—Transverse comminuted fracture on boundary between lower and middle third of calf. Symptoms of thromboangiitis obliterans had been present. Large necrotic area developed in heel region which did not respond to treatment, though high lumbar sympathectomy was done. Upper part of leg was amputated 9 months after fracture. Arteriogram shows obstruction in femoral artery (Courtesy of Koskinen, E.V.S Ann chir et gynaec. Feminae 47·99-114 1958.)

(9) Ann. chir et gynaec. Feminae 47·99 114 1958

7 patients with fracture and dislocation of a lower extremity leading to gangrene amputation had to be performed in 6 (Fig 96) The injury was in the leg in 6 (Fig 96) and in the neck of the femur in 1 Two patients had a bilateral injury Most fractures were comminuted

Exploration in the cases of lower leg injury revealed the anterior tibial artery was strongly compressed between the interosseous membrane and the tibia and fibula whereas the posterior tibial artery was dislocated between the fascia cruris profunda and the distal fragment of the tibia and distended. Neither artery showed rupture but signs of contusion could be observed in the adventitia

Once gangrene has appeared amputation is the only method of treatment All potential external pressure such as plaster casts should be eliminated as soon as the first symptoms of vascular injury appear Spasmolytics and sympathetic blocks should be applied or spinal anesthesia instituted Extensive incision and fasciotomy should then be done and any compressing hematoma eliminated As a subsequent measure *the arteries have to be explored and stripped of their* adventitia and potential lacerations sutured Arteriectomy should not be performed before other expedients prove of no avail Heparin should be used if thrombosis is suspected.

Fractures of External Tibial Plateau in Persons over 50 Years are reported by Jean Pillet[1] (Paris) The 43 patients aged 50-82 were observed between 1947 and 1956 During the same period only 1 patient over 50 was encountered with an internal tibial plateau fracture and 14 with T fractures of the upper end of the tibia.

Intra articular operation and nailing was done on 23 patients 1 with a spinoglenoid fracture 1 with a separated fracture without depression and 21 with fractures with depression (Figs 97 and 98) Average age of this group was 58.9 years with a range of 50-74 Results were considered excellent in 3 good in 11 fair in 4 and poor in 2 In 2 final results were unknown and 1 case was too recent for analysis Age apparently had no definitive effect on the final result Operation was performed 3-21 days after injury There were no serious surgical complications One woman 77 died of cardiac and respiratory complications 10 days after fracture before orthopedic treatment could be administered

(1) J chir 75 72-86 January 1958

Early mobilization of these patients is important. Passive contraction of the quadriceps was begun the day after operation and active flexion and extension of the knee was started on the 6th day The anterior lateral patellar approach used



Fig 97 (top) —Preoperative x-ray of fracture with depression of left external tibial plateau and splintering of tibial margin.
Fig 98 (bottom) —Postoperative x ray after nailing and iliac graft implant.
(Courtesy of Pillet J J chir 75 72-86 January 1958.)

gives an excellent exposure without the necessity of cutting across any important structure. Active physical therapy first passive and then against weight, permits recuperation of muscle tone and the articular joint. When the patient walks with support about the 75th day his leg has normal muscu

lature and knee flexion is about 90 degrees re-education in walking is essential however to avoid a limp which may become habitual

Nineteen patients had orthopedic treatment without surgery of whom 2 were seen very late 3 with depressed fractures could not be operated on because of poor general condition and 14 had fractures without depression Average age of this group was 61 (range 50-82 years) In 2 cases results could not be evaluated, one was a fracture on the paralyzed side of a hemiplegic and the other was associated with a complex fracture in the other leg which required prolonged immobilization In 6 cases follow up was not obtained. Of the rest results were excellent in 2 good in 3 fair in 2 and poor in 3 This group included the most favorable and the most unfavorable cases Of 13 patients with nondepressed fractures in whom surgical treatment was withheld by choice follow up was impossible in 6 results were excellent in 2 good in 2 fair in 1 and poor in 2. Only one of these 7 patients was immobilized in plaster the others became ambulatory immediately

It is concluded that age has no direct effect on the degree of function recovered after fracture of the external tibial plateau and that operation presents no vital risk and also yields better functional results since patients with severe fractures with depression treated surgically showed better recovery than those with less severe fractures given orthopedic treatment Anatomic reconstruction of the tibial articular surface and early mobilization seem to be essential factors in treatment of these fractures

Bicondylar Fractures of Tibia Of 26 fractures of the upper end of the tibia observed in a 3 year period by J Lataste[2] (Paris) 8 (30.7%) involved both condyles Good anatomic and functional results were obtained in 5 of 7 patients operated on the 2 with poor results required secondary arthrodesis The patient who did not have surgery recovered good function despite a mediocre anatomic result.

Woman, 28 was seen on the 15th day of orthopedic treatment for Y-shaped tibial fracture with severe displacement, frontal splitting of the shaft, an articular lesion of the internal condyle and fracture of the peroneal diaphysis (Fig 99) A wide internal arthrotomy was done with a limited external extra-articular approach. There was no lesion of the meniscus Osteosynthesis was achieved with 2 nails and a

(2) Presse méd 66 116 119 Jan 22 1958

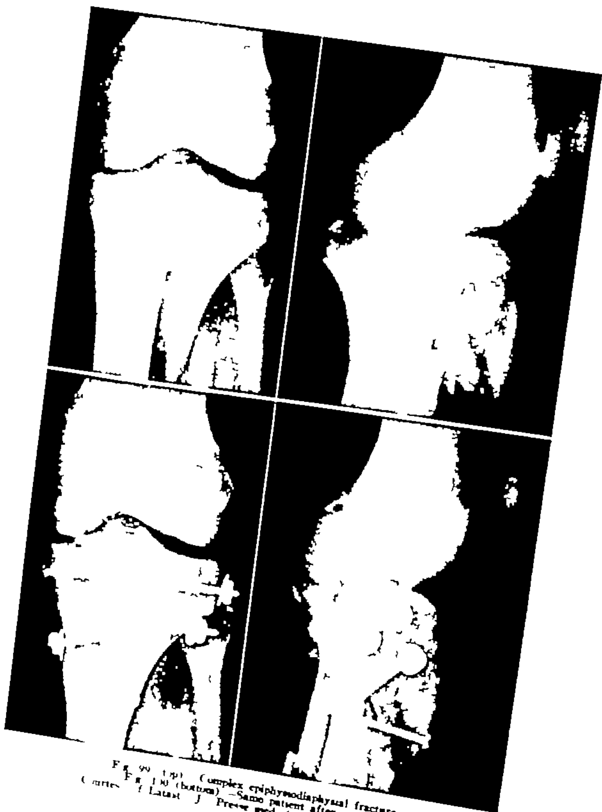


Fig. 99 (top). Complex epiphysodiaphyseal fracture.
Fig. 100 (bottom). —Same patient after surgery.
(Courtesy of Lataste J. Presse med. 66 116 119 Jan. 22 1958.)

screw The patient was mobilized immediately The anatomic result was excellent (Fig 100) but the operation was too recent to evaluate functional results

Depending on the mechanism of the bicondylar fracture the articular lesions may be classified in five groups fracture separations, separation with central sinking separation with peripheral or complete sinking separation with tearing and complex fractures These lesions which generally cause articular disruption and detachment of a lateral ligament are associated with subarticular epiphysial epiphysial metaphysial or epiphysial diaphysial lesions

Treatment depends on the type of lesion but its fundamental aim is immediate or rapid mobilization Orthopedic treatment is generally only indicated in fractures with minimal displacement In some complex fractures in which any attempt at osteosynthesis would be precarious benefit might be obtained from plaster immobilization to be followed by later operation on consolidated fragments if the functional result is poor Operation is the ideal treatment provided a good anatomic approximation and solid support are obtained. This is accomplished by internal fixation after a wide arthrotomy usually unilateral sometimes combined with a cortical bone graft or a second nail in certain types of subarticular fractures.

Open Tibial Shaft Fractures Immediate Soft Tissue Closure. W Adrian Freeman and Arthur L. Garnes[3] (Harlem Hosp New York) advocate immediate wound closure in open tibial shaft fractures because the soft parts heal within 14-21 days repeated contamination of the wound is avoided induration and scarring are minimized repeated dressings are unnecessary ambulation is earlier *hospitalization* is shortened and medical cost is minimized

In the ambulance phase management entails control of hemorrhage prevention of further contamination and fixation of the extremity for transportation During the emergency ward phase physiologic and chemical deviations are corrected the integrity of other vital structures and organs is determined and antibiotic therapy is instituted

The operating room phase consists in debris surgery and reconstructive surgery In the former the objectives are

(3) Am. J Surg 95 415-424 M reb 1958.

cleansing or preparation of the extremity removal of devitalized and disorganized tissue by debridement and exploration of the wound Before during and after debridement the wound is irrigated with a large volume of sterile saline The objectives of reconstructive surgery are repair of vital



Fig 101 —Anteroposterior view of comminuted, compound fracture f upper third of left tibia. (Courtesy f Freeman, W A., and Garnes, A. L.: Am J S rg 95 413-424 March 1958.)

structures blood vessels nerves and tendons reduction and immobilization of the fracture in the simplest possible manner and closure of the skin without tension

Tension is one of the greatest hazards to effective wound closure The length of the laceration or diameter of the wound seems to have little relation to healing if tension and infection are avoided. To eliminate tension some type of skin graft may be indicated. Since free skin grafts will not remain alive when applied to exposed bone pedicled flaps



Fig 102 (left) —Soft tissue wound over fracture before surgery
Fig 103 (right) —Healing of soft tissue defect closed with bipedicled contiguous skin flap 22 months posttrauma.
(Courtesy of Freeman, W A., and Garnes, A. L.: Am. J Surg 95 415-424 March, 1958.)

are used These may be obtained from tissue adjacent to the defect (Figs 101 103)

► [Delay in definitive care of open fractures until a more convenient time for the operator has resulted in needless infection, morbidity amputation or death. Early thorough cleansing of the wound and immediately thereafter closure of the soft tissues, whether or not it is deemed advisable to reduce and immobilize the fracture as a part of the primary procedure, will turn most open fractures into closed fractures and thus eliminate most of the danger faced by the patient.—Ed.]

Subastragalar Dislocation (Luxatio Pedis sub Talo) Follow up Report of Eight Cases is presented by Hans Walther Larsen [4] Subastragalar dislocation implies a dislocation between the talus on the one side and the navicular and calcaneum on the other in such a way that the talus remains in its normal position and the navicular and calcaneum retain their connection with the forefoot. The dislocation has been classified into four groups medial (supination)

(4) Acta chir scandinav 113 380 392 1957

ateral (pronation) anterior and posterior To cause subas ragalar dislocation the injury must be severe and the foot must be in a position that is favorable for the occurrence of such dislocation The condition occurs generally as the result of a spring plunge or fall from a great height or when the patient falls while the foot is fixed It can also result from di rect injury

Medial dislocation is the commonest form of subastragalar dislocation. Clinically the condition resembles club-foot de-



Fig 104 (left) —Subastragalar dislocation of medial type in women, 57 Left foot had been hit by motorcycle, causing foot to twist inward. Small splinter is located at back of angle between talus and calcaneum.

Fig 105 (right) —S bastragalar dislocation of posterior type in man, 54 who fell from roof, landing on feet fter clear fall of 2 1 meters. Right foot became twisted inward. Calcaneum and forefoot are displaced medially At back of angle between talus and calcaneum, loose splinter from posterior astragalar process can be observed. (Courtesy f Larsen, H. W Acta chir scandinav 113 380-392, 1957)

formity (Fig 104) Closed reduction is done by bending the knee to an angle of 90 degrees placing the foot in plantar flexed position then drawing the forefoot distally The foot is pronated and flexed dorsally and the normal position thus regained

Lateral dislocation is the next commonest form At the time of the accident the foot is pronated and flexed dorsally The anterolateral corner of the talus is pressed against the anterior calcanean process which then acts as a fulcrum for the movement. When the dislocation occurs the talonavicu lar and interosseous talocalcanean ligaments are torn Often the deltoid ligament is severed also causing damage to blood

vessels nerves and tendons The position of the foot resembles that found in a flat foot When performing closed reduction an assistant grasps the forefoot and heel and draws in distal and plantar direction The operator stands at the patient s side grasps the lower part of the leg with one hand and at the same time presses the calcaneum on his flexed knee He can thus direct the head of the talus and the foot with the free hand

Anterior dislocation is the least frequent form of subastragalar dislocation Clinically the heel is flattened, whereas the foot is extended but has mainly retained its normal direction For closed reduction the foot must be drawn distally to such an extent that the posterior surface of the calcaneum is released from the sulcus tali An attempt can then be made to direct the foot backward

Posterior dislocation is recognized clinically by a projecting heel a shortened forefoot and in the main retention of the normal direction of the foot (Fig 105) In closed reduction the forefoot is plantar flexed with release of the neck of the talus from the upper edge of the navicular the heel is drawn in plantar direction to release the posterior astragalar process from the sulcus calcanei and the foot is drawn distally

Follow up of the 8 patients treated showed that subsequent results were good in all with uncomplicated dislocations and those accompanied by minor fractures All had freedom from pain but most had slight though not incapacitating limitation of movement in the subastragalar joints All were able to resume their former employment. In 1 complicated dislocation the result was not good and the patient had pronounced limitation of motion and arthrotic symptoms

Treatment of Fractures of Os Calcis should be guided according to Morton H Leonard[5] (El Paso Tex.) by the x ray findings Mild fragmentation of the tuber of the os calcis without joint involvement the result of a direct blow can be treated by brief plaster immobilization. An injury with considerable di placement of a portion of the tuber which exerts pressure on the skin and threatens to cause necrosis requires manipulation or open operation The usual routine with patient who do not require surgery is to immobilize the foot and nkle in a short leg cast for 3-6 weeks

(5) A M.A. Arch. S 5 990 997 December 1957

followed by non weight bearing mobilizing activities and then free weight bearing in a shoe that is appropriately padded.

Fractures which involve the posterior subastragalar joint with minimal displacement are also treated in this manner Fractures with severe involvement of the posterior subastragalar joint cause prolonged temporary and serious permanent disability Three common methods of treatment are early mobilization the method of Böhler and early arthrodesis These methods even without triple arthrodesis eventually give satisfactory results Firm fibrous union takes place though it requires about 18 months Until union occurs the patient has painful feet and great disability The foot often remains deformed with no arch and a broadened heel Arthrodesis leaves a broadened heel and a flat foot. Open reduction of certain fractures of the os calcis can shorten the duration of the disability and often results in a foot approaching normal in function and appearance

When a fracturing blow strikes the heel the fracture occurs in the os calcis between the tuber and the sustentaculum This fracture line often extends into the posterior subastragalar joint If the force continues with the weight from above as in a fall or with pressure from below as when the heel is broken from a rising surface the lateral fragment of the os calcis continues to advance against the talus and subchondral compression of the os calcis results With recoil a ledge is left in the posterior subastragalar joint To correct this ledge the compression is relieved by open reduction elevation and position being maintained with a bone graft When the entire facet is depressed it too is replaced by open reduction. Leonard obtained best results with open reduction modified after the method of Palmer

TECHNIC—The patient is placed on a regular operating table with the involved side elevated or in prone position. A Kirschner wire is placed through the tuber of the os calcis and held in a sterile bow The incision is of short Kocher type Dissection is carried to the peroneal tendons which are reflected with their sheaths anteriorly The sural nerve which runs almost in a line of the incision is visualized and carefully retracted It is necessary to cut the calcaneofibular and anterior talofibular ligaments to inspect the posterior subastragalar joint. The facet of this joint is usually in two pieces with the lateral piece depressed. At times the entire facet is depressed or there is a central depressed portion.

An elevator is placed through the aperture made by the buckling

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Vea Med Orient. 16.262 265 Nov Dec. 1957

of the lateral wall of the os calcis under the depressed portion while traction is being maintained on the heel via the Kirschner wire. The depressed portion of the posterior facet of the os calcis is elevated and position is maintained by bone graft placed in the resulting defect. Homogeneous rather than autogenous bone is used to avoid further disability in a donor site. This practice is important in industrial cases.

The joint is inspected and, if possible the ledge or ledges are visualized This visualization is difficult Packing the bone into the defect *may produce a diastasis of the joint surface hence x rays are made in* the operating room to assure that good reduction has been obtained. If it has not any displacement is corrected. If the articular surface is comminuted elevation of the fragments permits earlier fibrous fusion and shorter disability The tourniquet, which is always used, is released and hemostasis secured The wound is then closed in layers.

A long leg plaster cast with the knee at 45 degrees to relax the gastrocnemius muscle is applied with a piece of rolled felt molded under the fibular malleolus to prevent spread of the lateral portion of the fractured os calcis The pin is incorporated in the cast. Even when good reduction is not obtained because of comminution of the articular facet which does occur the end results are most satisfactory The severe valgus deformity which sometimes resulted after the Böhler method of treatment, is no longer present. The fibrous fusion that apparently occurs in the subastragalar joint as in the Bohler method, gives a painless foot in shorter time.

The long leg plaster is left in place for 6 weeks, then cut down so the patient may start knee motion and worn for an additional 6 weeks. Weight bearing is not permitted until the graft has revascularized sufficiently as indicated by homogeneity of the trabecular pattern on x rays. Revascularization is usually complete in 12 weeks, but the rate depends on whether cancellous or cortical bone has been used. When more time seems necessary the patient carries out non weight bearing mobilizing activities during the waiting period.

By use of the described technic Leonard often is able to return a man to heavy work within 4-6 months He has had no experience with early mobilization in smash fractures.

► [The arguments set forth in this paper are convincing and the results impressive. The same fractures can be successfully treated by restoring the tuber joint angle, molding the fracture fragments with the Böhler redressor and maintaining reduction by a plaster cast that incorporates a pin through the os calcis and a second pin through the tibia. If these patients are permitted early partial weight bearing the soft new bone will be smoothed out by movement of the joint surfaces and few painful arthritic subtalar joints will result —Ed.]

Some Significant Aspects of Fractures of Calcaneus were studied by Arnold D Piatt[6] (Newark O) The tuber joint angle, termed also the salient angle the angle of incidence and Bohler s angle is formed by the intersection of a line drawn from the posterior superior margin of the tuberosity to the high point of the posterior subtalar articular surface

(6) Radiology 69 831 December 1957

and a line projected along the subtalar articular surface extending from the anterior superior tip of the calcaneus to the same high point of the posterior subtalar articular surface. This angle normally has a wide variation, 10-40 degrees. In compression fractures with displacement of the tuberosity or subtalar articular surface, flattening of the angle occurs and it may even reach a negative or reverse phase, indicating the extent of the depression of the longitudinal arch. The tuber joint angle should not be confused with the crucial or critical angle. The latter is the stress buttress on the lateral aspect of the subtalar articular surface that accommodates the spurlike wedge of the talus.

A study of the calcaneus is incomplete unless in addition to lateral and axial views, Anthonsen's oblique projection and inversion-oblique x-rays are included. A Bucky axial view of the injured heel and a comparison lateral film of the uninjured heel are of considerable value. Anthonsen's oblique projection is obtained with 25 degree tilt of the tube to the foot of the table and 30 degree angulation toward the toes with the heel in a lateral plane and the foot dorsiflexed. The central beam is just below the medial malleolus of the tibia and passes toward the long axis of the calcaneal sulcus. This view best discloses the posterior portion of the subtalar joint. For the inversion-oblique x-rays the foot is inverted so that the dorsum closely approaches the film and the central ray is at right angle to the table top passing through the midbody of the os calcis. This position shows more readily fractures of the promontory or anterior lip of the calcaneus as well as tarsal bars, often obscured by overlap of the lower anterior portion of the talus. One variation of the axial view is the so-called Harris position, in which the patient, while standing, rests the injured heel on the film holder and flexes the leg forward on the foot as much as possible. The tube is tilted 45 degrees with the central beam passing in dorsal plantar direction through the center of the body of the calcaneus. This examination allows better visualization of the posterior subtalar articulation.

Any alteration in the physiologic mechanics of the foot after a calcaneal fracture is subject to many factors. The principal elements involved are maintenance of the fine balance of the articular surfaces to carry the stress of body weight in various positions and strength of the bone de-

pending on an intact cortical structure Normally the subtalar joint permits lateral tipping of the foot to adjust to uneven surfaces In most calcaneal fractures the major impact usually falls on the posterior subtalar joint surface Consequently the eventual function of the foot after this injury depends on what happens to the subtalar joint and how much secondary fixation is allowed to develop in the foot. Traumatic osteoarthritis may occur as a late complication with prolonged disability especially when the joint has been damaged and distorted

When the injury causes upward displacement of the tuberosity the site of insertion of the Achilles tendon is displaced upward which has the effect as of lengthening the tendon, causing difficulty in standing on tiptoe There is also impairment of the normal heel and toe movement in walking which depends on the power of the calf group of muscles Excessive passive dorsiflexion of the ankle joint occurs concomitantly When broadening of the heel results from vertical crushing and lateral displacement of the outer bone fragment a disability may result if there are associated malunion and excess bone formation beneath the tuberosity Pain is most often present on weight bearing or when a valgus foot derangement is the aftermath from this type of injury Valgus deformity of the heel usually is due to displacement outward of a large posterolateral segment of the calcaneus.

In fractures of the os calcis the disability may not be so much malunion as the indirect effect of the fracture on the lateral balance of the foot due to involvement of the subastragaloid articulation and the resultant traumatic arthritis. The tendency to joint disintegration is lessened by good anatomic reposition

The amount of compression and comminution is directly related to the force of the momentum There seem to be two fairly constant patterns of crush fractures of the calcaneus The commonest is depression of the anterior portion of the lateral major fragment, with bulging outward of the lateral wall The depressed fragment lies inside the lateral wall Another major fracture line may appear horizontally from the crucial angle to the posterior border of the tuberosity The tuberosity is forced upward and backward relative to the body becoming separated from it as the primary fracture line opens up The fractured portion of the sustentacu

lum tali and medial part of the bone is driven downward and inward Comminution may be so extensive that the entire subtalar joint may be shattered and even the cuboid joint involved In the other pattern of crush injury, the confor mation is almost the same except that a secondary fracture line runs behind the joint across the body so that a large piece of unbroken bone which is the outer half or two thirds of the posterior subtalar joint surface is depressed into the spongy portion of the body The tuberosity is in normal alinement with the body Foreshortening of the calcaneus occurs

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THE SPINE AND PELVIS

A Psychiatrist Looks at Backache Problem. According to Joseph Deuel Sullivan[7] (New York Hosp) backache is a simple complaint that often has a simple cause and a simple remedy will suffice. However this simple complaint often masks psychophysic complexity The patient with backache may be in the first stages of psychologic invalidism There may also be an undiagnosed local condition which has become a central point of hostility between the patient and physician Either or more commonly both of these condi tions are present when psychiatric help is sought. Most pa tients with back pain have some local condition which causes the pain

The psychiatrist is called in usually after the symptoms have been long established and generally he is faced with a patient who has chronic disability and psychologic invalid ism. Therefore it is hardly worthwhile for him to distin guish between psychogenic and organic cases Back disa bility may arise when unbearable anxiety is the driving force leading to the disease or injury and also to delayed or indefi nitely postponed recovery Under such circumstances hos pitalization operation physiotherapy and exercise may have little value Unless the sources of these feelings of frustra tion are removed or at least externalized through discussion or the patient is somehow given new hope he may remain ill Psychotherapy does not directly influence the physical find-

(7) Rheumatism 14:20-27 January 1958.

ings but it attempts to deal with the sources of frustration.

When flight into illness is suspected many back patients have a shell of pride and exaggerated toughness or pseudo-virility which makes them unusually contemptuous of the gentler methods of psychotherapy. When the therapist does penetrate resistance and reaches the patient, biologic healing forces ameliorate the physical disability.

The patient's concept of backbone may be associated with implications of lack of character, perseverance or courage. Spinal injuries may provoke ideas of impotence or paralysis. The thought of operation for a disk or a fusion may reactivate fears of death or meningitis. Most people are not too much troubled by these things or if they are, they deal with them quite well but there are those who for one reason or another may have been especially proud of the "strength of my back." This attitude is unfortunately common among physically strong men, athletes and workmen among whom back injuries and hypertrophic osteoarthritic changes are common. Several possibilities arise here to prolong convalescence. The longer the recovery the greater may be the compensation to the pride of the injured patient. Often the future is looked on much more blackly than the reality warrants.

Old neurotic difficulties or character conflicts may be lighted anew by back pain where it occurred before at a psychologically important time in life, e.g., a patient as a young girl may have had backaches associated with menstrual periods. The back pain is likely to make the patient aware again of long forgotten needs. Because of the patient's own helplessness he may find again the pleasures of dependency and domination which may now be exerted over those who are bound to him by sympathy and responsibility.

Many psychoneurotics present themselves with a complaint of backache. To these the physician has his gravest chance of doing damage. Such patients may be thoroughly interviewed and examined without undue focusing on the low back or the orthopedist's particular field of interest. Some doctors check and recheck organic possibilities out of pseudoscientific completeness. Such examinations and x-ray studies are likely to do the patient more harm than good.

Patients with morbid depressions that are not clinically obvious experi[illegible]ce ineffectiveness, lack of interest, impo-

tency shame and guilt feelings If at the same time they have backache a well meaning relative may insist that the patient consult the relative's doctor who did so much for his own back pain previously The diagnostic emphasis may shift under such circumstances due to lack of understanding of psychiatric problems Exhilarated patients may present themselves at the physician's office with any kind of trivia including backache Under certain conditions when there is possibility of duty evasion psychopathic personalities particularly those of blander disposition seek to take advantage of the complaint of back pain These are well known to the physician who has had military experience. It is probable that this diagnosis and the consequent disposition of the problem are a bit overdone by the military

Many patients with back pain have demonstrable physical pathologic findings and at the same time are neurotic. Many of these are postlaminectomy and postfusion patients Symptoms here wax and wane and in many patients emotional factors play a role in the condition

Sullivan emphasizes that backache belongs with the general practitioner who has some background and interest in psychologic medicine that the concept of the intervertebral disk as the major cause of back pain has unjustifiably dominated medical thinking that laminectomy and fusion should be confined to far fewer patients that proper study of manipulation may have been neglected by the profession and that an assembly line approach to the patient with back pain has arisen with overroutinism of diagnostic and therapeutic procedures

Changes in Venous System in Cervical Osteochondrosis were studied by Hans Helmut Baacke[8] (City Hosp Berlin) In spondylosis deformans the various and extensive osseous changes seen in x rays are often asymptomatic This suggests that degenerative changes alone cannot account for the pain experienced by some patients To determine the possible cause of pain arteriography of the vertebral artery and its branches was done on cadavers No important encroachment of the skeleton on the arteries was observed The conditions in and around the veins however are different. Their thin wall and relatively low blood pressure render them more susceptible to the influences of their surroundings

(8) Fortsch Geb Röntgenstrahlen 87 7 1 26 December 1957

Studies were made on 25 cadavers with cervical osteochondrosis and no history of pain and on 3 with a clinical history of shoulder and neck pain Contrast medium was injected into the vertebral vein before its entry into the brachiocephalic vein In clinically asymptomatic cervical osteochondrosis the vertebral venous plexus was narrowed in the area of the disk and marginal spurs of the upper and lower vertebral plates (Fig 106) Above the narrowing only slight

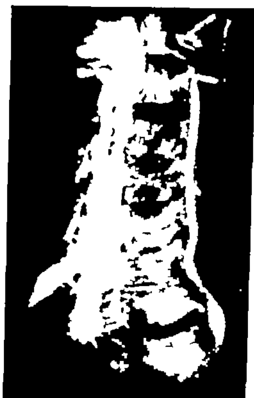


Fig 106—Arterial and venous filling in osteochondrosis cervicalis. (Courtesy of Haacke, H H Fortsch Geb. Rontgenstrahlen 87 721 726, December 1957)

widening was noted The contrast medium circumvented the area of degeneration flowing through the anastomotic channels and the less affected vessels on the opposite side.

The findings differed in the specimens with a history of shoulder and neck pain In one the longitudinal vertebral sinus was visible only in the upper part of the cervical spine. In another specimen the narrowing of the internal venous system within the area of degeneration was only vaguely apparent. In a third specimen the longitudinal vertebral sinus was exceedingly slender and bilaterally compressed

These findings suggest that shoulder and neck pains may be due to congestion in the internal venous system which in turn is caused by the stenosing action of dorsal vertebral spurs

Etiologic Study of Back Pain was conducted by Ralph K Ghormley[9] (Mayo Clinic) in 2000 cases The commonest cause was osteoarthritis (table) Patients with this condition frequently are free from symptoms so long as they do not indulge in hard work or other activity which may cause local irritation around the vertebrae and incite pain

DISTRIBUTION OF 2000 CASES OF BACKACHE ACCORDING TO CAUSE

Cause	Number	Per Cent of 2,000 Cases	Sciatic Pain, Cases
Osteoarthritis	311	2.0	44
Protruded disk suspected	445	22.3	334
Indeterminate causes	384	19.2	34
Static disturbance present	100	8.0	4
Rheumatoid spondylitis	131	6.5	3
Coccygodynia	3	5.[illegible]	1
Previous trauma (old fracture usually)	53	2.0	3
Spondylolisthesis	44	2	0
Tuberculous spondylitis	38	1.0	3
Osteoporosis	30	1.8	1
Recent trauma other than fractures	31	1.0	0
Recent fractures	25	1.3	1
Spondylolyses	13	0.7	2
Scoliosis	11	0.0	0
Metastatic neoplasms of vertebrae	11	0.6	1
Fibrositis	8	0.4	0
Previous fusion operation	7	0.3	1
Primary neoplasms of cord and soft tissues adjacent to vertebrae	5	0.3	2
Gynecologic disease	5	0.3	1
Infectious spondylitis (osteomyelitis nontuberculous)	3	0.2	1
Previous operation for protruded disk, with or without fusion	4	0.2	2
Facet syndrome	4	0.3	0
Primary neoplasm of vertebrae	3	0.1	0
Vertebral epiphysitis	3	0.1	0
Paget's disease	1	0.1	2
Interspinous ligament syndrome	2	0.1	1
Sacralization partial	[illegible]	0.1	0
Metastatic neoplasm of cord and adjacent soft tissue	1	0.1	1
Compensation neurosis	1	0.1	0

9) Radiology 70 649-653 May 1958

Of 445 patients with suspected protruded intervertebral disk 161 (36%) were operated on In 121 a protruded disk was removed without performance of fusion whereas in 26 patients removal and fusion were performed Among 14 in whom a protruded disk was not found at operation fusion was performed in 8 About 73% of the 445 patients also had sciatic pain

In 384 patients the back pain was of mixed type, the exact nature of which was difficult to determine. Backache, brought on by activity and relieved by rest, represented 8% of the entire group Usually some mechanical fault is present in such cases though it may not be demonstrated by x rays Rheumatoid spondylitis was seen in 131 patients (6 5%) Pain and stiffness in the morning obvious limitation *of motion of the spinal column and limitation* of chest expansion are important diagnostically especially before the x ray signs become apparent. The 55 patients with coccygodynia were for the most part psychoneurotic. Fifty two (2 6%) had had antecedent trauma Spondylolisthesis and spondylolysis were seen in 57 patients (3%) These conditions are readily diagnosed by satisfactory x rays. Tuberculosis of the spinal column seen in 38 patients may be easily missed particularly in the early stages when the x ray changes are minimal or absent.

Damage to an intervertebral disk may occur and frequently may cause transient attacks of back pain with or without sciatic extension Such damage without actual protrusion of a disk or disks may lead to subsequent x ray changes To say on the basis of x ray studies alone that such a lesion is the cause of a patient s pain does not seem justifiable

Consideration of Pre-existing Conditions, Congenital and Acquired in Preplacement Spine Examination According to Wayne A. Simril[1] (Washington Univ) abnormalities that will be discovered in an adequate pre-employment x ray study of the lumbar spine i.e. anteroposterior lateral and both posterior oblique views fall into these groups (1) conditions secondary to disease, acute or degenerative (2) conditions secondary to trauma and (3) congenital anomalies

Hemivertebrae congenital scoliosis secondary to tilt of

(1) Radiology 70 654 660 May 1958.

the 5th lumbar vertebra neural arch defects with spondyloschisis or spondylolisthesis and unilateral sacralization or lumbarization are of major importance These abnormalities which often are the cause of pain and instability are not compatible with good function in a man expected to do heavy labor

Accessory ossicles unfused epiphyses spina bifida occulta hiatus canalis sacralis complete or partial failure of segmentation in the mid or upper spine bilateral sacralization ossified ligaments absence or abnormalities of the spinous and transverse processes and kissing' spinous processes are not of clinical significance Denying employment of any sort is not justified on the basis of discovery of one or more of these conditions if unaccompanied by physical signs Variations in degree of lordosis or angulation at the lumbosacral junction are equally unimportant unless based on an actual abnormality such as soft tissue contracture in the low back.

Healed or asymptomatic fractures of spinous and transverse processes are relatively unimportant. Healed fractures of apophysial facets or vertebral bodies are more apt to be associated with damage to intervertebral disks and with instability

Congenital anomalies most apt to be confused with traumatic changes are unfused epiphyses and accessory ossicles Another developmental abnormality often mistakenly considered acutely traumatic is spondylolisthesis Perhaps even more commonly reported as traumatic is the wedged vertebra of healed Scheuermann s disease

Roentgenographic Abnormalities in Soldiers with Low Back Pain Comparative Study Frederick J Fischer Murray M Friedman and Robert E Van Demark[3] (Bruns Gen'l Hosp Santa Fe N M) report x ray findings in 200 soldiers aged 19 51 who presented themselves consecutively because of lumbar and sacroiliac pain. Practically all had had strenuous military training and many had been in combat. For comparison 100 soldiers who had never had back injury or pain were also studied.

Spondylolisthesis was present in 29 soldiers in the study group compared with 6 in the control group Of these 28 had true spondylolysis Twenty four had bilateral defects in

(3) Am. J Roentgenol. 79 673-676, April, 1958.

the region of the pars interarticularis of the 5th lumbar vertebra and 4 had unilateral defects Of the 28 soldiers with spondylolysis 17 had associated spondylolisthesis Fourteen had associated spina bifida occulta of the 1st sacral segment —an incidence of 50% compared with 39% for the entire study group

Of the 29 subjects with spondylolisthesis degenerative arthritis occurred in 6.9% narrowing of the lumbosacral intervertebral joint space in 13.7% increased acuity of the lumbosacral angle in 6.9% and rounding of the anterior margin of the sacrum in 20%

Degenerative arthritic changes in the lumbosacral and sacroiliac joints were found in 9% of the study group compared to 5% in the control group Three subjects in the symptomatic group presented moderate to advanced changes of rheumatoid arthritis of the sacroiliac joints Narrowing of the lumbosacral intervertebral joint space was found in 17% of the symptomatic patients compared with 11% in the control group An increase in the acuity of the lumbosacral angle was encountered in 5 5% of the patients compared with 2% in the control group

Persistent Backache, one of the commonest complaints of man has many causes according to Edward L. Compere and William T Kernahan Jr[3] (Chicago) Etiologically persistent backache can be subdivided into five types chronic low back strain osteoarthritis of lumbar articulations congenital anomalies of the lumbosacral region chronic inflammatory lesions of the lumbosacral joints and metabolic disturbances of the muscles ligaments and joints in the lower back.

Most patients with chronic fatigue characterized by persistent backache lead sedentary lives and rarely participate in outdoor activities Many of these work daily at tasks they find uninteresting or onerous Tired housewives office workers and schoolteachers make up the largest group of patients who are given the diagnosis of chronic back strain. These patients complain that they have no appetite and are tired all the time. They appear listless their tissues are flabby and there is a lack of tonus in all the muscles. Ligaments which should be strong and taut to support the great

(3) M. Clin [illegible]rth America 42 299-307 January 1958.

load of the body where the spine joins the pelvis are relaxed and elongated

Another large group with chronic low back strain is composed of persons who have had severe injuries to muscles or ligaments

Relaxation of ligaments of the pelvis including the lumbosacral articulations occurs during the latter months of pregnancy Additional stretching of the sacroiliac and symphysial ligaments occurs at the time of delivery This may be the beginning of persistent backache that could be prevented A lumbosacral corset should be worn for 6 weeks after each pregnancy and delivery to protect the ligaments until they regain their normal length and consistency

Osteoarthritis of the lumbosacral spine may include the erosion of cartilage within the articular facet joints spur formations around the margins of the articular facets and the more obvious marginal osteophytes on the contiguous portions of vertebral bodies Osteoarthritis results from the minimal traumas produced by everyday activities Marked osteoarthritic changes are commoner in the spines of persons who have worked at hard physical labor for many years Any degree of instability of the articulations in the lower lumbar spine increases the wear and tear on the articular facets and upon the margins of the vertebral bodies Repeated overloading of the spine as in lifting and carrying heavy objects results in reduced elasticity and efficiency of function of the intervertebral disks The disk space becomes narrowed resulting in increased motion between contiguous vertebrae irritation of one vertebra against the other increased range of motion in the facet joints and shifting of weight back onto the articular facet joints Wear and tear changes follow producing edema of the ligaments facet degeneration and osteophyte formation. Similar changes may follow surgical removal of an intervertebral disk without simultaneous arthrodesis of the spine.

Gradual disintegration and dehydration of intervertebral disks in the aging process are also causal factors in osteoarthritis of the spine. Scoliosis or lateral curvature of the spine, is usually associated with tilting of the 5th lumbar vertebral body toward one side. This tilt results in an unequal distribution of weight on the articular facets and leads to early degenerative arthritic changes in the overworked articular

facet joints sometimes causing severe persistent backache.

Congenital anomalies which may make the lower back susceptible to strain or arthritis include spondylolisthesis anomalies of the articular facets and sacralization or hemisacralization of the 5th lumbar vertebral body. Spondylolisthesis may be present before birth as a developmental anomaly. This condition rarely causes backache during childhood or adolescence. Because of the defect in the bony arch at the lumbosacral joints the ligaments and muscles must support the entire weight of the body. These overburdened ligaments may become elongated and swollen and cause persistent backache.

Abnormal rotation of the articular facets known as tropism results in greater strain on the capsule and ligaments of these joints and greater than normal wear and tear on the articular facets. Degenerative changes which follow may be expected to cause persistent backache.

Sacralization or hemisacralization of the 5th lumbar vertebral body results in an abnormal accessory joint or joints. The butterfly wing shaped enlarged transverse process of the 5th lumbar vertebra has poor articulation with the sacrum and in many instances the wing of the ilium. Movements between the 5th lumbar vertebra and sacrum cause friction and irritation across the superior portion of the sacroiliac joint. Such friction and irritation may be expected to produce local reaction of edema of the ligaments and lameness. The complaint of patients thus affected is that they are never entirely free from discomfort or low back pain.

Chronic inflammation of the lumbosacral area may cause edema and congestion in the subcutaneous fat ligaments and tendinous attachments of muscles to the sacrum and ilium. Chronic inflammation may be caused by focal infection such as chronic tonsillitis an abscessed tooth gallbladder or urinary tract disease. Localization of inflammation in the lower back area is more likely to occur if the muscles and ligaments are edematous from being stretched and overrelaxed as a result of malposture or other static conditions.

Patients who are emotionally tense may find it impossible to relax. Anxiety fears or worry often confined to the subconscious can produce mental tension which is reflected in a concurrent increase in muscle tonus. Prolonged hypertonicity of muscles interferes with normal circulation of lymph

and blood creating chronic passive congestion in the connective tissues Persistent passive congestion within any soft tissue structure results within a short time in tenderness and aching—a common cause of persistent backache

Rheumatoid arthritis and other low-grade infections in the joints of the lower back area may also cause persistent low back pain

Metabolic disturbances such as those associated with gouty diathesis must be considered in seeking the cause of persistent backache Disturbances of calcium phosphorus and protein metabolism may result in osteoporosis of the spine. This may weaken the vertebral bodies to the extent that one or more may collapse under stress of weight and normal activities The strain of weight bearing on the porotic vertebrae and/or the pathologic fracture of vertebral bodies may cause persistent backache.

Chronic low back strain should be treated by lumbosacral corsets rather than by rigid steel braces Other therapy may include a low-carbohydrate high protein diet with adequate vitamins exercises carefully supervised by a physical therapist, until the malposture has been corrected and until the ligaments and muscles which support the back have regained normal length and strength If there is clinical evidence of marked relaxation of the ligaments which support and stabilize the pelvic bones and lumbar spine these ligaments can be shortened and made firmer by injection of a mildly sclerosing solution such as Sylnasol*

The osteoarthritic spine requires rest which permits reduction of the irritation caused by surfaces rubbing together This tends to reduce edema and repair the injured tissues

Patients with congenital anomalies who have severe pain or are disabled should be considered candidates for arthrodesis of the lumbosacral spine. If spondylolisthesis is the cause of backache fusion usually results in complete recovery If the operation is performed because of both backache and sciatica, the posterior vertebral processes including the laminae and articular facets of the vertebral segment which is defective should be removed.

In treating hemisacralization it is often advisable to fuse both the lumbosacral and sacroiliac joints. If the joint shows arthritic changes and clinical findings indicate that part of the pain is from the articulation which has been carrying

more than its share of body weight and strain this sacroiliac joint should also be fused. Painful osteoarthritis of one or both sacroiliac joints is commonly associated with or secondary to sacralization of the 5th lumbar vertebral segment.

Chronic inflammation in the lumbosacral area may be caused by rheumatoid arthritis in the articular facets. The resultant edema and congestion of the muscles and ligaments may cause persistent backache. Fibromyositis also produces chronic backache. Heat and massage or the use of an orthopedic corset or brace afford little relief. Markedly tender areas designated as "trigger points" should be injected with 1% procaine containing 1 or 2 cc. Hydrocortone®. When the problem is primarily one of low grade congestion or inflammation in the soft tissues in the lumbar and lumbosacral area, carefully supervised exercises are recommended.

Treatment for persistent backache associated with osteoporosis should include use of a strong back brace, a diet rich in proteins, vitamin D in an alcohol solvent such as Drisdol® and by buffered sex hormones.

Vertebral Slipping by Rotation and Its Clinical Importance are discussed by K. Reinhardt[4] (Hamburg). This condition is revealed radiologically by a ledge or step in the lateral contour of the spine (Fig. 107) and has sometimes been termed erroneously "lateral displacement." The ledge presented by the vertebral column results from a rotary movement executed *in the apophysial articulations themselves* around an axis passing through the base of the spinous apophysis or through a point further back. The vertebral body represents in some way the large hand (pointer) of rotation and the spinous apophysis the small. Consequently *lateral deviation of the vertebral body exceeds that of the spinous apophysis. In anteroposterior projection* the base of this posterior apophysis contributes considerably more to formation of the radiographic image than its point and lateral deviation of the latter often remains concealed (Fig. 108).

Of 88 patients (69 men) with slipping by rotation only 4 presented marked scoliosis. In 15% there was moderate, in 31% slight and in 30% minimal scoliosis. In 19% scoliosis was completely lacking. In most patients with marked or moderate scoliosis the vertebral curvature had appeared at

(4) J. radiol. et électrol. 38: 905-915, Sept.-Oct. 1957.

an advanced age Rotary slipping may appear with congenital scoliosis but this is rare

The author believes that degeneration of the disk is usually primary and that scoliosis is often the result and not the cause of rotary slipping an opinion shared by many Results of this study support this concept.

Spondylotic prominences were present at the level of rotary slipping in 71 patients In 28% of these the disks were not thinned at the point of rotation The 17 patients without



Fig 107 (left) —Slipping of vertebra by rotation. Second lumbar vertebra projects toward right side, indicating rotation round dorsal axis.

Fig. 108 (right) —Slipping of vertebra by rotation with axis of rotation passing through base f spinous process. Lateral displacement of body is more pronounced than that of spinous apophysis.

(Courtesy of Reinhardt, K. J radiol. et électrol. 38 905 915 Sept.-Oct., 1957)

these prominences had slipping of recent origin A nucleus pulposus because of its swelling favors rotary slipping more than a degenerated flattened nucleus In most cases there was displacement of the articular apophyses in a craniocaudal direction Exact verification of this at the point of rotary slipping was often impossible because of the non orthogonal projection but it was sometimes demonstrable by tomography

Rotary slipping is impossible without subluxation of apophysial articulations in the horizontal plane physiologic rotation ceases when subluxation begins The tendency to rotation is perhaps also provoked by anterior flexion of the vertebral column When this is strong in a normal column the possibility of lengthening the range of the arcs can be

used to the limit In the extreme position resistance of ligaments and disks as well as of antagonistic musculature exercises a torsion force which the vertebrae cannot resist if their ligamentous and discal junction is altered If the palm of the hand is placed on the line of the spinous apophyses while the patient flexes the trunk an increase in scoliosis is demonstrated by a slight curve in the vertebral column

Rotary slipping was toward the right in 60% of cases. Changes at the lumbosacral junction are of particular importance in rotary slipping In 11% there were 6 lumbar vertebrae in 15% the last lumbar vertebra was not fully developed in 5% the iliolumbar ligament was unilaterally calcified in 74% the last vertebra was out of alinement and thus assumed a position of rotation

Rotary slipping may involve one or several vertebrae. Two vertebrae were involved in 20% of this series 3 in 5% and 4 or 5 in 1% In patients with scoliosis slipping was located mostly in the caudal portion of the curvature often in the cranial part and rarely even higher In most slipping was located in the lumbar vertebrae The 4 cases of slipping of the dorsal vertebrae were in women The axis of rotation is determined by the form of the articular apophyses Rotation around a ventral axis is impossible in the lumbar spine because of the sagittal position of the articular processes.

Rotary slipping often causes a sensation of instability in the lumbar region and 80% of the patients had radicular or lumbar pain Prostatic hypertrophy was present in 28% and many patients complained of sexual impotence Kidney disease was present in 9% and stomach lesions in 5% There were too few cases to establish any correlation between the spinal difficulty and visceral symptoms or disease.

Residual Spinal Injuries from Automotive Crashes Biomechanical Considerations of Preimpact Impact and Post Impact Factors Involved in their Production. Jacob Kulowski[5] (St. Joseph Mo) reports results of a study of 250 patients who had injuries following automotive accidents. Injuries lasting for weeks or months were in the neck in 100 patients in the low back in 100 others and in both neck and low back in 50 About 80% of the vehicles involved were automobiles

To date, seating has been related chiefly to the poten-

(5) South. M J 51 367 372 March 1958.

tials of injury of current cabin design which seem to determine the clinical results However seating posture has other implications of equal or possibly greater significance Engineers refer to a basic mass-spring system the elastic quality of the spring action which determines the maximum deceleration in instances where a passenger is strapped to the seat and the rider-seat combination remains intact

From the biomechanical standpoint the unrestrained passenger achieves only a labile equilibrium This requires considerable flexibility in the lumbar region co-ordination and strength of the spinal and adjacent musculature as well as the other complex mechanisms involved in getting in and out of a vehicle These biochemical requirements are emphasized in the extraordinary instability of a body mass under crash conditions Moreover seating imposes certain static detrimental loads e.g stresses of retropulsion on the posterior interspinal ligaments via movements of the intervertebral disk increased tensile stresses on interlaminar ligaments and related anatomic tissues already under stress in response to the dynamics of the disk and the transfer of tensile (tension bar) stress from the symphysis pubis—normally present in standing—to the sacroiliac and iliolumbar ligaments already overworked even in standing and walking Further the usual slumped forward position tends to aggravate this situation

That in the seated posture biomechanical perfection is not attained is shown further by the dynamic reactions of passengers In the disk, reactions to vehicular vibrations may lead to biologic disturbances which ultimately may develop more serious pathologic conditions than those imposed by greater mechanical forces Additional stresses of inertia due to repetitious loss and gain of gravitational balance occur during ordinary changes of direction and velocity of the vehicle Body responses demand supportive action by the hip paravertebral and abdominal muscles aided by the foot support and hand holds Over long periods these supportive actions result in fatigue and discomfort.

The high degree of biomechanical requirements of an occupant especially a driver of a moving vehicle lifts muscular and skeletal fitness to new levels clinically About 80% of patients studied had various spinal defects or deficiencies Arthritis the major abnormality affected the cervical

spine in 60% of patients about a third of whom were drivers.

About 80% of the accidents were collisions less than 45% of which involved automobiles Linear more or less concentric acceleration/deceleration patterns predominated. Slightly less than half the cervical injuries were due to rear end impacts angular and forward collisions ranked next. About 25% of back injuries resulted from forward impacts, with rear-end collision and roll-overs ranking next The order of frequency for mixed lesions were angular "roll over" forward and rear end impacts respectively

Because of the many variables involved in automotive crashes clinical results are often obscured sometimes even by extraspinal complications as well as by accessory findings Spinal x ray studies were negative in 173 patients However before dismissing the ubiquitous diagnosis of sprain in these patients it should be remembered that the tensile stresses operating to maintain the intrinsic equilibrium of the spine (disk versus interlaminar and intervertebral ligaments) predispose the spinal column to sprains especially if there are spinal defects or deficiencies

► [The physician who is frequently asked to treat injuries resulting from automobile crashes should be informed as to the biomechanical considerations devised to help reduce injuries to the spine and spinal cord. All physicians should be interested in and should actively advocate the adoption of, measures which will help prevent such injuries.—Ed.]

Total Rehabilitation of Spinal Cord Injury Patient. A. Estin Comarr[6] (VA Hosp Long Beach Calif) emphasizes the need for the physician who cares for the spinal cord injury patient to know and understand the patient as a whole His general physical and neurologic condition should be determined in detail orthopedic status known and financial emotional and marital problems understood Only then can a well planned physical rehabilitation program be outlined For a team to be good each member of the specialist group must know the status of the patient in regard to whatever medical complications may exist

A rehabilitation program cannot be planned long in advance as daily changes in the patient s condition require flexibility An operation may prevent attendance at physical medicine session yet stretching the limbs can be done at the bedside The Hubbard tank may relieve spasticity in most patients but in some it creates greater spasticity One

(6) J Indian M A [illegible] 1928-1949 December 1957

patient demands more massage, another complains it aggravates symptoms.

The programs practiced by rehabilitation sections at the author's hospital include physical occupational and corrective therapy Once the basic medical program is satisfactorily in progress a counseling psychologist decides when the patient can start vocational training Social service relieves the physician of such problems as finances and housing for the patient's family during and after hospitalization, contacts various other agencies and employers and lays the groundwork for early discharge. The psychologist deals with personality problems which are noted and a special service provides recreation for the patient.

Because of a great deal of overlapping of functions all facilities should be in one area to permit consultations among departmental staffs The corrective therapists must have the bracemaker close by for adjustments or correction of braces, the physical and occupational therapists must discuss the progress of a quadriplegic and the vocational counselor must confer with the educational staff occupational therapist or perhaps the manual arts therapist to establish the patient's interests Yet it remains the physician's responsibility to co-ordinate and be final advisor to the patient. He must use sound judgment in determining when a patient needs encouragement and when force might only produce chaos Only the physician with understanding of the medical and psychologic burdens of a patient of this type can return a self sufficient citizen to the community

► [Motivation is the most essential element in successful rehabilitation of the patient with partial or complete resection of the spinal cord. If the patient is *determined* to develop and utilize all that he has left, he has a good chance to become again an independent unit of society He will need the combined facilities of a well-equipped and adequately staffed rehabilitation center An hour each day of physical and/or occupational therapy will never achieve the desired result. He must be in a complete program which demands his best efforts for 6 or more hours day after day if he is to be successful in his wish to become rehabilitated. For those who take full advantage of the opportunity time, effort and interest made available to them, the end result far more than justifies the cost.—Ed.]

Needle Biopsy in Differential Diagnosis of Destructive Processes in Vertebral Column is advocated by A. Koch E A Van Slooten and J F Hampe[7] (Amsterdam) if routine diagnostic methods are unsatisfactory and if severe pain or medullary compression signs are present.

(7) Arch. chir neerl. 10 41 50 1958

METHOD.—A special needle with a hollow stainless steel shaft 20 cm. long with a bore of 2 mm and a short circular bevel like a trephine is used. Over the 4 cm nearest the end the wall of the needle is *polished inside and out and has a thickness of 0.25 mm.* the rest of the shaft is twice as thick to give it the necessary strength.

A mandrin with a sharp three-sided cutting point is inserted into the needle and is used to perforate the corticalis of the bone. When the point of the needle has reached the marrow, as indicated by a slight decrease in the resistance the mandrin is withdrawn and the needle pushed forward with some force making slow to-and-fro rotary movements When the needle has been inserted 1 2 cm. into the marrow a vacuum syringe is attached to the hub The piston is drawn out and fixed and with the same careful rotary movements the needle is removed from the bone After the syringe is detached the specimen is pushed out of the shaft of the needle with another mandrin, which has a flat end. Susa s solution is recommended for fixation because it decalcifies the bone tissue and causes little shrinkage of the marrow

Aspiration of bone marrow cells only is often impossible, and in many cases no satisfactory material for cytologic study can be obtained

The successful use of this method as a basis for diagnosis is illustrated by the following case reports

CASE 1.—Man, 21 was hospitalized because of severe back pain for 3 weeks Physical examination revealed severe pressure pain on the 7th thoracic vertebra and x rays showed several centers of destruction in the body of the 7th thoracic vertebra and one in the 8th vertebra. A bilateral spindle shaped sharply demarcated shadow was observed along the affected vertebral bodies. The Pirquet reaction was negative Puncture biopsy of the 7th vertebral body proved the process to be a tumor probably a sympathicoblastoma.

CASE 2.—Man 77 treated a year previously for back pain, complained of pain in the left thigh and recurrent low back pain. The entire lumbar spine was painful to pressure. The apparently normal prostate contained a pea sized firm nodule. The root of the left vertebral arch of the 1st lumbar vertebra could not be found either on plain x rays or on planigrams and the vertebral body was not sharply demarcated. Needle biopsy of the 1st lumbar vertebra revealed metastases from prostatic cancer

CASE 3.—Woman 38 had low back pain. A firm round swelling 1 cm. in diameter was found under the right mandibular angle. It was said to have existed for 15 years and to vary in size from time to time. Puncture biopsy of the 12th thoracic vertebra revealed metastasis from salivary gland cancer

CASE 4.—Man 29 complained of pain in the right knee and thigh. Flexion of the lumbar spine was slightly restricted. On x ray examination the intervertebral disk between the 2d and 3d vertebrae appeared to be narrowed After unsuccessful radiation treatment for a supposed hernia, later x ray study showed the upper and lower border of the 3d lumbar body to be interrupted in several places. Treat

ment for tuberculosis of the spine was begun. When destruction of the base of the vertebral arch of the 3d lumbar vertebra was noted, puncture biopsy of the 3d lumbar vertebra was performed and some tumor cells were seen. The patient died shortly afterward. Autopsy revealed a (*primary?*) *malignant melanoma* in the right adrenal gland with metastases in the left gland and 3d lumbar vertebra.

CASE 5—Man 58, had been treated previously for tuberculous pleurisy and a tuberculous focus in the right shoulder Diminished sensibility in the legs loss of sense of micturition and other neurologic disturbances in the lower half of the body were noted. X rays showed the intervertebral disk between the 5th lumbar vertebra and sacrum to be slightly narrowed and the top part of the sacrum also had a clouded structure. A diagnosis of spondylitis tuberculosa was confirmed by puncture biopsy

CASE 6.—Woman, 62 had pain the entire length of the vertebral column. The thoracic spine was held rigid during all attempts at movement. X rays of the skull showed it to be thickened, whereas in the tibiae, left half of the pelvis humeri, radii ulnae and 11th thoracic vertebral body a coarse meshed structure of the bone was seen interspersed with sclerotic parts Vertebral needle biopsy indicated Paget's disease.

Specific Management for Lumbar and Sacral Radiculitis is described by Frederic B House and Sylvester J O Connor[8] (Ann Arbor Mich.) Low back pain due to hyperextension of the lumbar spine and associated with compression or irritation of the lumbar or sacral nerve roots may be produced by five pathologic conditions

The simplest and commonest cause is the facet syndrome. The facets of the 1st sacral vertebra are forced upward into a position of subluxation in relation to the lower facets of the 5th lumbar vertebra This produces encroachment on the foramen and stretching and irritation of the capsule of this small joint. The resulting irritation of the nerve root in the foramen causes most of the symptoms

Another common cause of the syndrome and one which may be a sequel of the facet syndrome, is osteophytosis of the spine. Osteophytes form around the small apophysial joints causing encroachment on the neural foramen.

The third, less common cause is forward displacement of one vertebra associated with a defect in the pedicle known as spondylolisthesis This again causes posterior tilting or hyperextension encroachment on the neural foramen and the syndrome as described

A fourth cause is protrusion or extrusion of the interver

(8) J.A.M.A. 166 1285-1290 M 15 1958.

tebral disk substance into the foramen which may irritate or compress the nerve root

The fifth cause is lumbar laminectomy itself for although the offending disk protrusion has been removed certain structural changes have taken place which make for an even greater tendency to posterior tilting or hyperextension than had existed before The situation may change from a threat of nerve root compression to one of simple nerve root irritation However patients so affected need the protection that comes from a logical conservative back program

A conservative treatment program in five steps is suggested to avoid the pelvic tilting associated with hyperextension of the lower vertebral segments

Method—*Step 1*—The patient should be instructed to avoid extension of the spine while in or out of bed. He should be taught how to maintain the proper position in bed and how to get out of bed without extending the lumbar spine

Step 2—The patient lying flat on his back with the knees bent and soles flat on the table should (1) learn to tilt the pelvis, exercising the abdominal and gluteal muscles (2) with the pelvis tilted (lumbar spine flat) straighten one leg at a time returning it to the bent position (3) with the pelvis tilted, raise the head and shoulders, then lower them keeping the back flat and (4) bring the knee toward the axilla assisting with the hands and arms.

Step 3—In the standing position with the heels 4-6 in. from the wall and the back against the wall the patient should (1) flatten his back against the wall (2) tilt the pelvis (flex the lumbar spine) and raise the legs alternately (3) stoop, raise the trunk and keep the back flat (4) with the pelvis tilted move out from wall rise up on the toes and return to the wall and (5) walk with the pelvis tilted.

Step 4—The patient should (1) while lying flat on his back with the knees bent and soles flat on the table, touch the fingers to the toes (2) do straight leg raising with the back flat (3) with the face down flex one knee under the abdomen to maintain flexion of the lumbar spine with the opposite hip hyperextended, counteracting any flexion deformity in the hip and then alternate sides and (4) from the standing position squat with the feet flat on the floor

Step 5—The therapist should consider the specific postural problems encountered in the patient's work and recommend ways the work can be done without extension of the lower segments of the spine.

Of 247 patients with low back pain and sacral or lumbar radiculitis only 18 (7%) failed to respond to this conservative treatment

Indications for Lumbosacral Fusion are evaluated by John R. Black[9] (Los Angeles) Psychologic factors must be con

(9) Californ M 1 88 12 15 J uary 1958

sidered in evaluating each patient Because pain is a purely subjective symptom the response of the individual to pain has a decided bearing on the indication for operation and on the result Patients involved in severe emotional or environmental stresses sometimes attempt to escape their problems by blaming their situation on a bad back. Adequate prompt treatment of protruded disk or other condition causing pain may be of great benefit to a highly sensitive neurotic or psychotic patient

What can be expected today of operations for intervertebral disk disease? It cannot be expected to return the patient s back to normal if by normal is meant complete unawareness of the back in any and all activities Such results are usually classified as excellent in most series the proportion of excellent results is about 2 3% There are many factors in evaluation of results in treatment of herniated disks not the least of which is the viewpoint taken by the evaluator Early in the history of surgical treatment of disk protrusion the operations were done chiefly by neurosurgeons As could be expected emphasis was on the degree of relief from pain in the legs residual pain in the back not being considered of great importance by the operating surgeon In other series the results were often judged by whether the patient returned to his former work or to some other work. This standard is of limited value it is probably more useful in industrial than in private cases Most physicians working in this field are well aware that because of economic pressures most patients will return to work despite residual disability The longer the follow up period, the greater will be the proportion returning to work

One of the most careful follow up reports was made by the Research Committee of the American Orthopaedic Association in 1952 on 250 patients with protruded disk who had been treated by excision alone In 59% results were satisfactory in the others unsatisfactory In another group of 118 patients treated by excision of the disk and spinal fusion some 69% had satisfactory results the rest, unsatisfactory The operations were done in 1941–45 It could be said of this survey that the surgical technics of today are probably better than in the years covered by the study but the study covered a longer follow up than most other series reported.

What results are to be expected from fusion in patients with low back pain without sciatica From a review of the reported cases Black places the satisfactory results at about 75% When operation is indicated he advocates routine fusion of the lumbosacral joint in all patients with protrusion of the 5th lumbar disk providing the spine above that level is considered essentially normal Black would do spinal fusion in all patients provided operation was indicated in whom the primary complaint was low back pain and sciatic pain was absent or minimal In such instances the fusion area should extend as far as necessary to include the portion of the spine involved in pathologic change. Only in exceptional cases would spinal fusion be done in patients over age 50

► [This is a thoughtful presentation of a controversial subject. Excision of a displaced intervertebral disk that is impinging on a nerve root will relieve sciatic pain. However loss of an intervertebral disk results in residual instability in the spine which may cause persistent lumbosacral backache Persistent backache after removal of a disk, without primary fusion is so common that the argument for fusion at time of removal of the disk demands thoughtful consideration.—Ed.]

Fusion of Spine for Tuberculosis in Children Long range Follow up Study Mather Cleveland David M Bosworth J William Fielding and Panayiotis Smyrnis[1] (New York) studied 18 of 42 tuberculous children who were treated by spinal fusion during 1929–41 None had antituberculous medication

Average age at operation was 5½ years Two patients died of meningitis The average age of the 16 survivors was 27 These patients were followed postoperatively an average of 21.7 years Preoperatively the average duration of disease was 21 months Fusion was done as soon as diagnosis was made and the patient s condition permitted

Tuberculosis involved the lumbar region in 4 patients, thoracolumbosacral region in 1 thoracolumbar region in 3 thoracic area in 9 and cervicothoracic region in 1 The average number of vertebrae involved was 5 segments The abscess generally extended beyond the vertebral involvement, necessitating a longer fusion than indicated by the number of diseased vertebral segments This was especially true in the thoracic area. In 9 the tuberculous involvement extended outside the spinal column

(1) J Bone & Joint Surg 40-A:91 106 January 1958.

Preoperatively 2 patients had paraplegia Both recovered with no recurrence after successful fusion In 3 patients paraplegia developed after the first attempt at fusion One died later of meningitis Another who became paraplegic but in whom pseudarthrosis did not develop after the fused lesion subsided recovered completely In the third patient the paraplegia was associated with pseudarthrosis This was successfully repaired and the patient recovered The 16 survivors showed no neurologic change indicating cord or nerve root pressure None of the 18 patients exhibited radicular symptoms at any time despite collapse of vertebral segments and reduction in size of the intervertebral foramens

Among the 18 patients 35 spinal fusions were done as primary procedures and 9 pseudarthroses were repaired Each procedure was basically a Hibbs fusion The average length of the fusion was 9 spinal segments There were no postoperative deaths or other major complications Fusions were done in more than one stage in many patients One patient had definite evidence of disease of the posterior elements of the spine In this patient pseudarthrosis developed after fusion without extra bone A second attempt to gain fusion failed when no extra bone was used fusion was finally obtained on a third attempt when extra autogenous iliac bone was used

Of the 16 survivors 9 are in excellent condition and essentially normal as judged by physical activity Four are in excellent condition but have moderate kyphosis which is apparent when unclothed 2 have marked kyphosis apparent even when clothed One has a pronounced deformity impossible to mask by clothing with severe constriction of the chest and loss of abdominal and thoracic space. All the patients with primary lumbar involvement had excellent results Disproportion (trunk versus extremities) is marked in 1 patient, considerable in 2 and noticeable in 2 Four have some disproportion on measurement, not otherwise noticeable

Four of the girls have grown up and married 2 of them have children. Two men are married and are fathers All the children are alive and well There is no record of abortion or sterilization and no evidence of transmission of tuberculosis to the offspring

Clinical and x ray examinations showed no apparent re tardation of bone growth of the extremities incidental to spinal disease Disproportion of the extremities with the trunk occurred when there was severe shortening of the spinal segment No gross disproportion occurred when involvement was confined to the lumbosacral spine No residual pelvic defects were noted in these adults as a result of removing iliac grafts from them as children

Kyphosis may at times develop as a result of fatigue-stress fracture of the fusion mass when spontaneous repair occurs unnoticed

It is suggested that paraplegia in a child due to vertebral tuberculosis demands spine fusion not laminectomy or evacuation of abscess

Osteotomy of Spine for Correction of Fixed Flexion Deformity is described by Paul L. McMaster[2] (Univ of California Los Angeles) The main indication for surgery is severe ankylosed flexion deformity of the spine not corrective by conservative measures and in which the patient has difficulty in seeing ahead Severe fixed flexion deformity of the hips of fibrous or bony nature in addition to the spinal deformity usually is a contraindication For the thoracolumbar deformity the optimum site of osteotomy is lumbar Ankylosis of costovertebral joints makes correction in the thoracic spine more difficult Cervical spinal osteotomy is rarely indicated

TECHNIC.—The operative technic of Smith Petersen is followed. The wedge of bone to be removed has its base posterior the apex lies at the anterior margins of the intervertebral foramens and the fulcrum of corrective motion is at the posterior margins of adjacent vertebrae One or two osteotomies may be done and the angle of correction to be obtained will correspond in general to the angle of the wedge or wedges A prone position is most commonly used. Careful operation with control of bleeding facilitates the operation The dura is apt to be thickened and adherent to the overlying ossified ligamentum flavum and may be punctured in stripping it away Thus flow of cerebrospinal fluid into the wound creates an additional operative problem Correction of the deformity after completion of the wedge or wedges consists in raising the head and foot of the table with approximation of the opposing oblique surfaces of the osteotomy Careful manual pressure is used at the osteotomy site to assist in closure of the posterior gap An audible snap may be heard during the correction which indicates separation of anterior ligaments Locking of the osteotomized surfaces and integrity of the posterior longitudinal

(2) A.M.A b S rg 76 603-610 April, 1958.

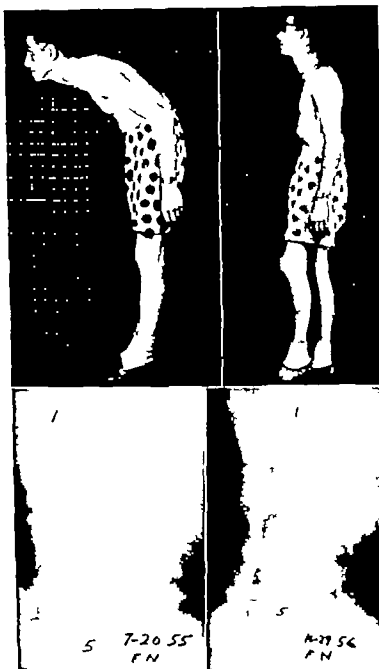


Fig 109 (top left) —Preoperative appearance of man, 32.
Fig 110 (top right) —Appearance 1½ years postoperatively
Fig 111 (bottom left) —Preoperative x-ray
Fig 112 (bottom right) —X-ray 15 months postoperatively
(Courtesy J M Master P E A M A Arch Surg 76, 603-610 April, 1958.)

ligament serve to insure against any displacement of a serious nature.

After correction and closure a posterior plaster shell extending to the knees is made. The next day an anterior shell is made. The patient should be turned often to prevent pressure sores. After 2 weeks, he is placed in a body cast extending to at least one knee. Bed rest is continued for 2 months followed by a back brace and gradual ambulation Careful observation of the patient and of x rays is necessary to prevent loss of correction At least 1 year is necessary for solid bony union sufficient to prevent loss of correction during this time a support should be worn

The author performed the described operation on 5 men, aged 30-46 with good results (Figs 109 112)

Pathogenesis and Treatment of Idiopathic Scoliosis Preliminary Report On the basis of chronaximetric myomechanical and histologic examination of the long spinal muscles Adam Gruca[3] (Warsaw Poland) assumes that idiopathic scoliosis is due to muscle imbalance at the level of its primary curve This dystonia may result from asymmetrical congenital or sometimes inherited segmental abnormalities of spinal muscle innervation or from reflex spasm induced by inflammatory lesions within or in the vicinity of the vertebral column in lungs or in mediastinal organs

The convexity of the angulation is always toward the weakened muscles The muscles of the scapula and arm have no influence on the production of scoliosis lateral shifting of the trunk being due to imbalance of the anterolateral abdominal muscles.

Scoliosis may be cured or its progress prevented only by early restoration of muscle balance The definitively damaged muscles must be replaced by transplantation of healthy muscles of the scapula or the arm (the trapezius rhomboider or latissimus dorsi) and the hyperactive muscles should be weakened by section or denervation The secondarily and temporarily weakened muscles must be strengthened by the introduction of artificial muscles In 1st-degree scoliosis this muscle alloplasty leads to full regression of the angulation or at least to considerable improvement and stabilization In 2d-degree scoliosis springplasty should be performed after stretching of the angulation of less than 30 degrees by conservative measures or by the spine liberation (Mayer) operation with temporary application o screw spring device or distracter 3d-degree s after

(3) J Bone & Jo t S rg 40 e 1958.

maximal correction of the angulation by conservative measures or by spine liberation and distraction the excess bone of the laminae and vertebral bodies must be removed and pulling springs applied in the second operation

The lateral shifting of the trunk due to dystonia of the obliquus externus and internus abdominis muscles may be successfully reduced by oblique fascial transplant after the method of Lowman with the use of the latissimus dorsi serratus anterior trapezius or tensor fasciae latae muscles

Follow up Study of Treatment of Scoliosis. Joseph C Risser and Donald M Norquist[4] (Pasadena Calif) report that of 347 patients (aged 1½ 39 years) with scoliosis on whom 619 spine fusions were done 1 died. In 3 paraplegia developed after spinal fusion exploration and decompression in 2 was followed by partial recovery

The method of spinal fusion used was the Hibbs subperiosteal dissection After curettement of the posterior articulations laminospinal osteal flaps were imbricated over the interlaminal space. More recently the authors elevated the *posterior half of the lateral facet. The base of the transverse* process was turned under the raised posterior facet Any remaining portion of the transverse process and laminal and spinal flaps were imbricated over the area of the facet. In 20 patients extra bone from the tibia was used.

Follow up study included only 75 patients with scoliosis from poliomyelitis and 167 with metabolic scoliosis In 171 patients spinal growth was incomplete when treatment was begun

The most deforming curvature was selected for correction and fusion If both thoracic and lumbar curves were severely deformed both were corrected and fused

Of 177 patients treated in the turnbuckle jacket results in 127 (72%) were classed good to excellent. Of 62 treated in the localizer cast results in 48 (77%) were similarly classed Loss of correction was 33% in the patients treated with turnbuckle jackets and none in 50 patients treated in localizer casts Causes of correction loss were poor selection of the fusion area an inefficient cast which did not hold the correction after spinal fusion and delayed fusion or pseudarthrosis The greatest losses were in patients with pseudarthrosis

(4) J Bone & Joint Surg 40-A:555-569 June, 1958

What Do Spot Films of Sacroiliac Joint Spaces Accomplish? (Contribution to Pathology of Sacroiliac Joints) H Kamieth[5] (Homburg/Saar Germany) found that spot films of the sacroiliac joint spaces give much more information that do survey films of the pelvis and may substitute for tomograms

Sacroiliac arthrosis except when far advanced cannot be diagnosed by pelvic survey films The arthrosis is charac

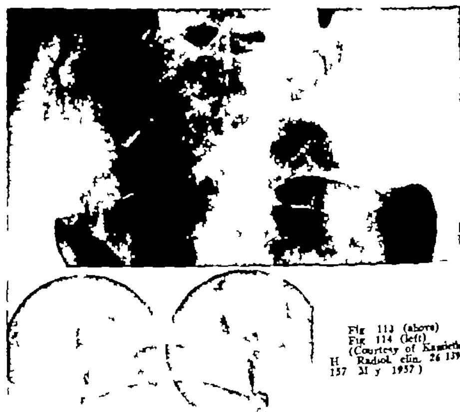


Fig 113 (above)
Fig 114 (left)
(Courtesy of Kamieth, H Radiol clin 26 139-157 May 1957)

terized by increased (band shaped) *subchondral sclerosis* narrowing of the joint space and irregularities in the outline of the joint. These signs can be detected only by spot films of the sacroiliac joint spaces The width of the joint spaces can be assessed only by comparison with the space on the opposite side. Spot films of the sacroiliac joint spaces are of great help in early tuberculosis s and Bechterew s disease

Figures 113 and ' from a who had severe back pain c survey sacroiliac

(5) Radiol clin 1957

joint space is irregularly widened not sharply defined and shows some sclerosis in the surrounding area The right joint space is narrower and sharply defined Because of the minimal side differences on the survey films diagnosis was uncertain The spot films (Fig 114) revealed the typical early changes of Bechterew s disease The right joint space is of essentially normal width On the entire iliac joint surface, especially on its lower part are rough subchondral foci of resorption surrounded by spongiosa sclerosis of adjacent areas increasing caudad In early Bechterew s disease there is definite difference in the pathology between the two sides

Contribution to Differential Diagnosis of Osteochondritis Ischiopubica is made by Lars R Holsti[6] (Helsinki) The disease is characterized by insidious onset, without apparent reason or after slight trauma or muscular exertion Of 15 patients with osteochondritis ischiopubica the commonest symptoms were limping pain and limitation of motion

X rays revealed a round ovoid or triangular pea to cherry sized swelling of granular appearance with several translucent areas within the swelling In Figure 115 there is one single area of translucency The denser areas are considered centers of ossification The border against the surroundings is sharp all around Neighboring bone tissues show normal structures no atrophy and no periosteal appo-



Fig. 115.—Osteochondritis ischiopubica in boy 5½ In right ischiopubic junction is hazelnut-sized swelling with pea-sized translucency in center (Courtesy of Holsti, L. R. Ann. chir et gynaec. Fenniae 46 458-468 1957)

(6) Ann. chir et gynaec. Fenniae 46 458-468, 1957

sition The swelling always projects into the foramen obturatum

Osteochondritis ischiopubica (swelling of the ischiopubic junction) in diseases of the hip and in static changes of the pelvis cannot be distinguished by x rays

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THE NECK, SHOULDER AND ARM

Two Cases of Subclavian Aneurysm Associated with Cervical Rib are reported by A Naylor[7]

CASE 1—Woman, 56 had pain of sudden onset in the right arm 3 months before hospitalization. The pain was followed by paresthesia, and since that time periodic attacks of pain and paresthesia occurred in the right arm and hand associated with weakness of grip. Examination revealed marked pallor of the distal two thirds of all fingers of the right hand No radial pulse could be detected On the right side of the root of the neck a swelling was felt which pulsated with the apex beat X rays revealed a complete cervical rib bilaterally At surgery the brachial plexus was found adherent to an aneurysm of the third part of the subclavian artery The plexus was mobilized and freed and the aneurysm resected. The anterior two thirds of the cervical rib was excised and the wound closed. Microscopic section of the aneurysm showed a thrombus adherent to its posterior and inferior walls No untoward symptoms were present on examination 2 months later

CASE 2.—Man 39 was hospitalized with a dull throbbing pain in the left forearm of sudden onset 3 months previously The pain gradually extended up the arm and was accompanied by a cold feeling in the fingers. When the fingers were cold the tips were blue. On examination, the left hand was cold clammy and blue. A pulsatile swelling was present in the left side of the root of the neck. X rays showed a complete cervical rib bilaterally At surgery an aneurysm of the third part of the subclavian artery was found. The aneurysm and anterior two thirds of the cervical rib were excised. One month after operation all joints of the left upper limb were capable of full movement the clavicle was firmly united and the left hand grip was equal to that of the right

Methods and Results in Treatment of 2 580 Painful Shoulders With Special Reference to Calcific Tendinitis and Frozen Shoulder Paul H Harmon[8] (San Francisco) presents a detailed analysis of 803 frozen shoulders 609 shoulders with medium and large calcium deposits (over 5 mm in greatest roentgen shadow) and 887 shoulders characterized

(7) Brit. M J 2 142 143 July 19, 1958.
(8) Am. J Surg 95 527 544 April, 1958.

by abduction pain tuberosity tenderness and no loss of passive motion (labeled supraspinatus tendinitis)

Pain was abolished and motion restored in 14 days in 314 (78.9%) shoulders with calcium deposits treated by injection of local anesthetics and/or Cortone* drug suspension followed by needling Recovery rate was the same in patients given Cortone* drug suspensions but the incidence of pain and immediate loss of motion was four times as great in those receiving local anesthetics only (16 4% as against 66 6%) Follow up on 276 patients 6 months to 2 years later showed maintenance of recovery in 81 1% Treatment of patients with asymptomatic deposits or with chronic symptoms by the injection method showed less clear cut response

Frozen shoulders with large calcium deposits are best treated by excision or needling before measures are taken to increase motion whereas shoulders with smaller deposits are primarily treated to restore motion Surgery is indicated for shoulders with acute and hyperacute large and medium calcium deposits Active motion through almost full range resulted in 79 8% of 104 shoulders 3-5 days after operation Surgical excision is also indicated in patients with medium and large granular deposits giving very chronic symptoms as the response to injections is not as good as in persons with subacute and recurring symptoms

The frozen shoulder syndrome contains primary and secondary types and causation (often multiple) and prolonging factors are not easily determined Of 803 frozen shoulders 54 3% were treated with gentle manipulation under anesthesia Immediate good results with motion maintenance were observed in 90% of cases in which there was sudden snap and release to full passive range Follow up studies 2 3 years later showed full painless motion in 64-94% Physical treatments and exercises over a longer period gave excellent results in two thirds of the rest (45.7%) of the entire group Manipulation under anesthesia is indicated if recovery with exercises is slow

Treatment with acromion resection including at least one face of the joint relieves pain in patients with prolonged abduction syndromes and affords increased motion in stubborn cases of frozen shoulder Excision of the outer 1-1 5 cm. of the clavicle benefits frozen shoulder patients with painful acromioclavicular joints

Common Affections about Shoulder Joint and Their Treatment. According to Raymond J Pellicore[9] (Univ of Illinois) from the viewpoint of therapy the pathologic entities around the shoulder joint may be grouped into four main categories acute and chronic bursitis musculotendinous cuff lesions cervical-dorsal outlet syndromes and myofascial affections

Acute bursitis usually follows minor trauma or occurs secondary to excessive use of the shoulder In many instances however there is no definite history of exertion or injury The diagnosis is usually simple and it is not negated by an x ray showing no calcific deposits

Treatment consists of immobilization oral medication injection and x ray therapy A patient who seeks treatment within 12 hours after onset of pain can be treated by immobilization and ice packs supplemented by analgesics or possibly cortisone derivatives or Butazolidin* Spontaneous recovery within 48 hours occurs in 30–40% of all acute bursitis patients An injection of 0.5 1% procaine with multiple punctures of the bursal sac usually gives immediate lasting relief Since the advent of intra articular hydrocortisone treatment has been simplified One cc is injected directly into the bursal sac With positive x ray evidence of soft calcific deposits either the 2 needle system irrigating the sac with saline or procaine is used or after the area has been anesthetized with procaine a large needle with a large syringe for aspiration In many instances a small amount of dried toothpaste like material can be aspirated Hydrocortone* can then be instilled into the bursal sac

Most patients with acute bursitis respond to these measures Failure to respond usually is due to the presence of a *large calcific deposit which requires surgical removal* Routine x ray therapy is condemned. Such therapy should be tried only in patients who are resistant to other treatment and before surgery is decided on

In chronic bursitis physical examination may show a full range of shoulder motion and no area of tenderness The condition responds to radiant heat and massage of the shoulder area followed by circumduction exercises with the arm in a dependent position and with a pendulum motion All motion should be at the scapulohumeral joint. To enhance the

(9) M Clin. North America 4 291 298 January 1958.

effects of motion a 2 3 lb weight of shot or sand bag is fastened at the wrist Holding this or other weights in the hand contracts all muscles of the extremity and prevents free scapulohumeral motion The exercise is done for 5 minutes about 5 times daily Within a week the patient usually becomes asymptomatic

In periarthritis there is persistent generalized shoulder pain with or without radiation and with marked limitation of all shoulder motion It may follow an attack of acute bursitis but usually the onset is so gradual that the patient does not seek treatment until secondary muscular contractures develop resulting in marked limitation of all scapulohumeral motions (the so called frozen shoulder) The shoulder pain may also be part of an acute rheumatic like symmetrical bilateral periarthritis and fibrositis Rest slight massage salicylates and steroids are indicated. There is a long history of pain with remission and exacerbation and with progressive restriction of motion Treatment includes radiant heat massage circumduction exercises cortisone salicylate compounds Butazolidin® or salicylate-codeine compound. If such treatment fails to alleviate pain within 10 days x ray therapy is indicated with a total of not more than 6-8 treatments Return of function can be accelerated by hospitalization and traction with gradual increased abduction Many authorities advocate repeated manipulation under general anesthesia with increased abduction at every subsequent manipulation.

Early diagnosis of a large or small rupture of the tendinous cuff is extremely difficult At times injecting procaine into the shoulder alleviates the pain If a patient is able to abduct and maintain the arm at a 90-degree angle or farther with slight resistance to abduction the tear is considered small enough to be treated conservatively However if abduction is impossible after alleviation of pain the presumptive diagnosis is a large tear of the cuff Another adjunct to diagnosis is injection of a radiopaque substance into the shoulder joint The x ray picture is characteristic

Whiplash lesions of the neck usually occur in a person seated in an automobile that is struck from behind by another car The jolt combines an initial backward thrust and a secondary forward snapping flexion of the head and neck First, the injured person notices nothing more than a slight

discomfort and stiffness of the neck for a few days In about a week he begins to experience occipital headaches which may be generalized but more often are confined to one side. Associated with this he may have blurred vision nausea and occasionally dizzy spells Pain radiates from the back of the neck to one or both shoulders and occasionally down the arm to the hand along the ulnar nerve distribution. The patient feels better in a horizontal position and after a night s sleep When a vertical position is resumed the pain gradually returns and increases in intensity

Physical examination reveals no cranial nerve injury There is full range of wrist hand elbow and shoulder motion Rotation and lateral bending of the head are limited and painful unilaterally and occasionally bilaterally Flexing the head produces a pulling sensation in the neck but hyperextension is painful There is spasm of the trapezius and longus splenius capitis muscles with a tender point at the upper vertebral angle of the scapula also a tender point in the occipital region at the insertion of the muscle

Hospitalization with intensive prolonged treatment should be insisted on Treatment consists of keeping the patient horizontal with cervical traction Helpful adjuncts are hot damp packs a horseshoe-shaped pillow or hot water bottle under the neck to keep the head in a neutral position It is essential for the patient to remain in a neutral position without hyperextension or flexion Physical therapy consisting of radiant heat and intermittent cervical traction with pulls of 30-40 lb is the most beneficial treatment

Arthrographic Studies of Shoulder Joint. Graham A Kernwein Bertil Roseberg and William R Sneed Jr[1] (Rockford Ill Mem l Hosp) report their experiences with arthrography in 96 problem shoulders Arthrography of the shoulder is a simple safe easily interpreted clinical test, providing accurate information not otherwise available without an exploratory operation. It is indicated in any case in which diagnosis is doubtful

TECHNIC —The tender region around the shoulder joint is anesthetized and the comparative strength of abduction and range of active and passive motion are determined. Anteroposterior x rays are made with the shoulder in internal and external rotation. The patient is then placed supine on the x ray table, and axial x rays are made to

(1) J Bone & Joint Surg 39 A 1267 1279 December 1957

visualize the intertubercular groove So that the arm does not lie on the table it is supported in a neutral position at the patient s side. The skin just below and lateral to the coracoid process is anesthetized and a 3-in. no 20 spinal needle is inserted into the joint. Twenty cc. of 35% Diodrast® solution and an equal amount of distilled water are thoroughly mixed and injected into the shoulder joint under x ray control The contrast mediums dilate and fill the joint space. After 40 cc. of the fluid is injected or a definite resistance is encountered the syringe is detached and 10-20 cc. filtered air is injected The needle is then removed. After careful manipulation of the shoulder joint photo-timed spot anteroposterior x rays are made with the shoulder in in ternal and external rotation. Axial x rays showing the intertubercu lar groove are also made. If the tendon sheath contains the biceps ten don, it will be seen as a filling defect in the contrast medium

The examination is relatively painless In the authors' se ries there were no complications Tissues removed from shoulder joints into which Diodrast® had been injected at periods ranging from several weeks to over 1 year before were found to be indistinguishable microscopically from those taken from shoulders in which no Diodrast® had been used. Diodrast® disappears completely from the shoulder joint in 2 3 hours after injection leaving no x ray trace.

The following seven features are considered normal find ings in contrast medium arthrographic study (1) The cap sule being elastic and expansile balloons out as it fills with contrast medium (2) Along the medial side of the neck of the humerus the capsule extends for about ½ in and hangs relaxed to form a small pouch. (3) The subscapular bursa communicates with the shoulder joint the contrast medium fills this bursa, so that it is visualized outside the shoulder joint and just below the coracoid process (4) The synovial lining of the joint surrounds the biceps tendon and extends down the intertubercular groove for 2 in where it ends abruptly It fills readily with the opaque medium and is seen as a narrow pouch about the size of a cigaret. (5) The gle-noidal labrum is visualized as a band of lesser density ex tending vertically inside the joint. (6) On the superior sur face of the humerus the capsule ends abruptly at the anatomical neck, where it forms a smooth sharply defined line (7) The liquid volume capacity of a normal adult shoul der joint is about 20 cc The only arthrographic difference between an adult s and a child s shoulder is in liquid volume capacities

A communication between the scapulohumeral joint and



Fig. 116. Arthrogram of shoulder with large tear in supraspinatus tendon. Complete dislocation of long head of biceps, found at operation, is not shown. (Courtesy of Kernwein, G. A. et al. J. Bone & Joint Surg. 39-A 1267-1279, December 1957.)



Fig. 117.—Rupture of tendon of long head of biceps brachii and associated rotator-cuff tear with [illegible] ing loss of abduction power. (Courtesy of Kernwein, G. A. et al. J. Bone & Joint Surg. 39-A 1267-1279, December 1957.)

the subacromial bursa indicates complete rupture of the shoulder-cuff mechanism The bursa is seen as a sharply defined cap perched above the humerus outside the shoulder joint (Fig 116)

Complete rupture of the tendon of the long head of the biceps muscle is easily recognized clinically by the altered con



Fig. 118.—Arthrogram of same patient showing rupture of rotator cuff with biceps pouch obliterated by adhesions. (Courtesy Kernwein, G. A. *et al.* J Bone & Joint Surg 39-A 1267 1279 December 1957)

figuration of the arm when the muscle is flexed (Fig 117) An associated lesion in the rotator cuff is usually found accidentally In 2 of the authors patients with coexisting rotator cuff lesions (Fig 118) the joint showed an increased liquid volume capacity also the subacromial bursa could be seen In 1 patient adhesions between the tendon and the surrounding synovial tissue were sufficient to obliterate the biceps synovial pouch

In all 96 problem shoulders three main characteristic arthrographic pictures were found. The first considered normal was common to a variety of conditions including those with no proved primary shoulder disease. The second, indicative of rupture of the rotator-cuff mechanism showed increased liquid capacity of the joint also the subacromial bursa The third found only in the presence of organic scapulohumeral fixation revealed an inelastic nondistensible capsule and considerably reduced joint space the other characteristics of this picture were normal

The arthrographic findings were correlated with the pathologic condition at operation in 54 patients Of the 35 in whom the diagnosis was complete rupture of the shoulder cuff mechanism and who later had operations 33 had a demonstrable lesion Of the 33 8 had coexisting complete dislocation of the tendon of the long head of the biceps 2 had complete rupture of the biceps tendon 4 had a calcified supraspinatus tendon and 3 had a history of recurrent dislocation of the shoulder joint with rupture of the capsule at the glenoidal labrum

► [This presentation dramatically demonstrates the value of arthrography in the diagnosis of certain lesions of the shoulder joint when diagnosis has otherwise been doubtful. The accuracy of arthrography as demonstrated by these authors is greater than most orthopedic surgeons have realized. This diagnostic procedure should be used in selected cases by surgeons who treat lesions of the shoulder —Ed.]

Winged Scapula. Donald J O Brien[2] (Florence, Ala) discusses diagnosis and treatment in 28 patients The commonest cause of winged scapula is acute or chronic trauma. In some patients a toxic or infectious factor is present, or the trauma may result from carrying heavy weights on the shoulder A patient with marked palsy of the serratus anterior is unable to elevate the arm or extend it forward All of the author s patients were able to elevate the arm fully although many noted weakness in doing this The commonest prominent symptom is pain usually extending along the base of the neck and down over the scapular and deltoid region of the affected side.

When the serratus muscle is weak the inferior angle of the scapula is permitted to rotate medially (Fig 119) At rest however the vertebral border of the scapula may appear normal particularly in incomplete palsies In most patients

(2) South M J 51 191 199 February 1958

winging is easily recognized by watching the vertebral border of the scapula as the patient slowly lowers his arm from an abducted, elevated position (Fig 120) Usually winging appears at a point less than 90 degrees or in the horizontal position

Criteria for diagnosing winged scapula include (1) history of adequate acute or chronic trauma (2) winging of the af

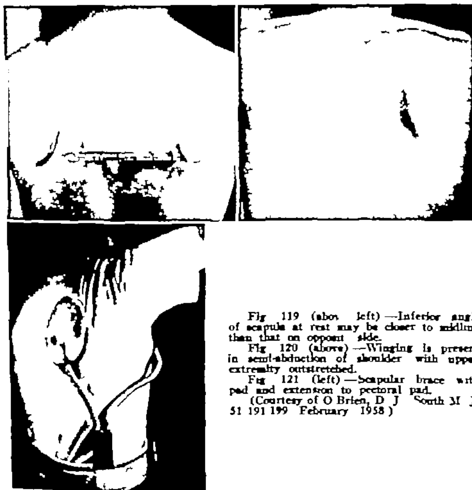


Fig 119 (above left) —Inferior angle of scapula at rest may be closer to midline than that on opposite side.

Fig 120 (above) —Winging is present in semi-abduction of shoulder with upper extremity outstretched.

Fig 121 (left) —Scapular brace with pad and extension to pectoral pad.

(Courtesy of O Brien, D J South M J 51 191 199 February 1958)

fected scapula in abduction, (3) pain on abduction or elevation (4) *inability to abduct and elevate* (5) *symptoms* around the shoulder girdle and (6) unilateral involvement without round shoulders or scoliosis

The procedures used in treatment were use of a scapular brace and shoulder girdle exercises The scapular brace consists of two flexible steel wires extending anteriorly and posteriorly and ending in a thoracic pad and a scapular cup re

spectively Riding of the pads is restricted by a webbed belt which encircles the opposite side of the chest and is attached to each pad (Fig 121) Exercises included shrugging the shoulders forward forward flexion and elevation of the extended extremity against gravity and pushups from a standing position, with the arm thrusting the body from the wall

Surgical rather than conservative treatment may be required Three general types of operations done are fixation of the scapula to the underlying ribs substitution of the adjacent subscapular nerve for the long thoracic nerve and muscle transplants The third type seems to provide the best operative results

Supracondyloid Process of Humerus an anatomic variant that may be of practical significance to the physician was studied by John W Marquis, Andre J Bruwer and Haddow M Keith[3] Knox in 1841 first recorded the occurrence of a supracondyloid process in man (Fig 122 *B*) Before him, Tiedemann in 1822 published an illustration of the process (*A*) Struthers (1854) gave an accurate anatomic description of the process a more or less hook shaped process, which is occasionally developed on the inner surface of the humerus two inches above the internal condyle. A ligament is continued from it to near the condyle completing an arch through which the median nerve and the brachial artery pass after deviating from their usual course. Mandruzzato (1938) depicted the relationship of the nerve and vessels (*C*)

Generally the patients are asymptomatic and the process is accidentally discovered The patients usually complain of a bump on the arm Some show evidence of irritation or compression of the median nerve There is pain along the course of the median nerve that varies from moderate to severe and is usually increased by pronation of the forearm or by flexion of the elbow joint. Palpation of the arm reveals an abnormal bony prominence about 2 in proximal to the median epicondyle

This anomaly is often not recognized roentgenologically the process is generally called an exostosis or osteochondroma An osteochondroma would be differentiated in this region by the fact that its long axis would point proximally not distally as does the supracondyloid process The process is generally bilateral but not infrequently it is unilateral

(3) Proc Staff Meet Mayo Clin 32 691-697 Nov 27 1957

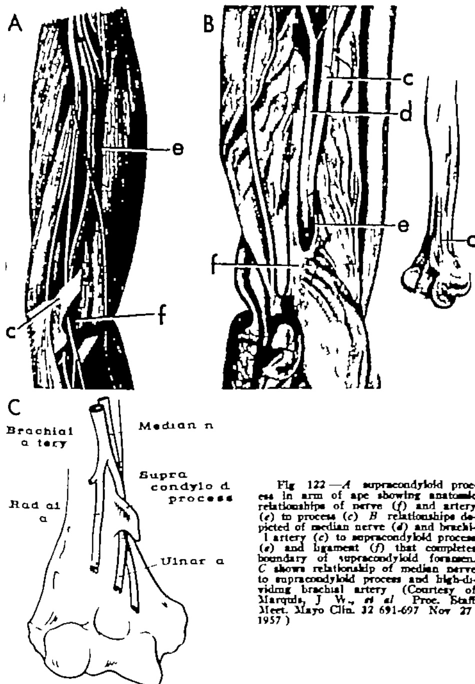


Fig 122 —*A* supracondyloid process in arm of ape showing anatomic relationships of nerve (*f*) and artery (*e*) to process (*c*) *B* relationships depicted of median nerve (*d*) and brachial artery (*c*) to supracondyloid process (*e*) and ligament (*f*) that completes boundary of supracondyloid foramen. *C* shows relationship of median nerve to supracondyloid process and high-dividing brachial artery (Courtesy of Marquis, J W., *et al* Proc. Staff Meet. Mayo Clin. 32 691-697 Nov 27 1957)



Fig 123 —A anteroposterior view of left lbow Humerus masks this well-developed process it is noted only as slight protrusion from medial aspect of humerus. B, lateral view show well developed process projecting above surface of humerus. (Courtesy f Marquis J W, et al Proc Staff Meet. M yo Clin. 3 691-697 Nov 27 1957)

Roentgenologically the supracondyloid process i a distinct entity that can be recognized best by taking tangential views of the lower part of the humerus to reveal the hooklike or beaklike nature of the process (Fig 123)

Surgical excision of the bony process is the recommended treatment for patients with symptoms of median nerve compression

Intraosseous Vasculature of Distal End of Humerus with Special Reference to Capitulum Preliminary Communication. Stefan Haraldsson[4] (Lund Sweden) studied the topography of the intraosseous vasculature in the distal end of the humerus especially that of the capitulum by injecting contrast material consisting mainly of white lead into the vascular system Lohr suggested that the capitulum of the humerus receives its blood supply mainly from branches given off by the arteria recurrens interossea and from the arteria collateralis media (Fig 124) The main vessels supplying the capitulum come from behind and enter the bone at the junction between the joint cartilage and the bone

(4) Acta rthop andina 27 81 93 1957

The author found that as long as the nucleus of ossification of the capitulum of the humerus lies isolated in the epiphysial cartilage it receives its blood supply via a few vessels entering the cartilage from behind and forming intercommunicating vessels in the nucleus of ossification At this

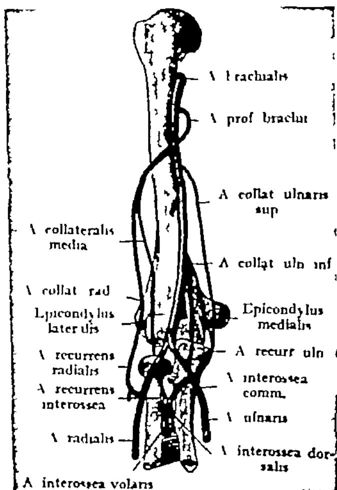


Fig 124—Intraosseous vasculature of distal end of humerus (Courtesy of Haraldsson, S. Acta orthop. scandinav 27 81 93 1957)

stage of development the vessels of the nucleus do not communicate with the other parts of the distal end of the humerus

The nucleus of ossification of the capitulum humeri extends into the radial part of the epiphysial cartilage of the trochlea. Part of the trochlea is thus ossified from the ossification nucleus of the capitulum Vessels are seen to extend to the future site of the ossification nucleus (nuclei) of the trochlea

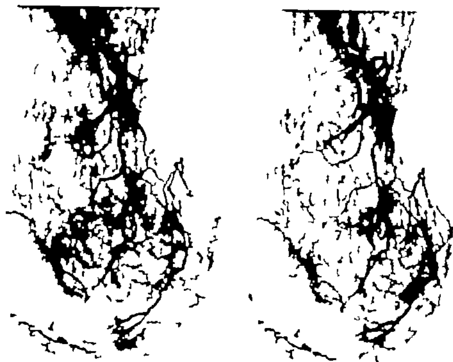


Fig 125 —Stereoscopic pictures of [illegible]ted trochlea. (Courtesy of Haraldsson, S Acta orthop. scandina 27 81 93 195)

before the bone salts deposited there have reached a concentration high enough to be visible by x rays

The topography of the vascular system forming in the capitulum during the period of ossification persists practically unchanged in the adult bone After ossification of the cartilage between the various nuclei of ossification of the epiphysis and of the epiphysial plate the blood vessels of the diaphysis metaphysis and epiphysis intercommunicate (Fig 125)

Painful Elbow New Approach. R. Meyer[3] (Jerusalem) suggests that the condition called tennis elbow or epicondylitis later this is caused by friction between the orbicular ligament and the radial head during pronation and supination and by pressure of the common head of the radial wrist extensors on the orbicular ligament during flexion of the elbow against resistance Resection of the ligament in properly selected patient gives complete and immediate relief without impairing the power of the muscles and the stability of the joint

TECHNIC —The common head of the extensor muscles is split in the direction of its fibers exposing the ligamentous structures The orbicular ligament is resected and free movement of the radial head during pronation and supination is demonstrated. (In 1 of the author s patients a considerable quantity of fluid escaped when the joint cavity was opened) On withdrawal of the retractors the muscles usually fall together like the two halves of a curtain and hide the radial head In such a case the skin only is sutured otherwise the muscles must be approximated by 1 or 2 stitches. In every case full active movements are *insisted on from the start*

The author used this procedure only when tenderness was most intense over the radial head Patients more sensitive to pressure over the lateral epicondyle as a rule responded favorably to conservative treatment.

► [Epicondylitis of the lateral epicondyle of the humerus does occur but it is more rare as a cause of tennis elbow than is impingement of a portion of the orbicular ligament. Most of the patients on whom I have operated have demonstrated a buttonhole tear in the orbicular ligament, with a portion of it displaced into the radial humeral joint. This displaced portion of ligament is pinched each time the radial head is forced against the capitellum of the humerus This occurs whenever the hand is closed in a firm, grasping position, and the pain is increased when the forearm is pronated or supinated. Removal of the split-off portion of the orbicular ligament, or all of the orbicular ligament if it was badly frayed, did provide prompt relief from pain and a good functional result in these cases.—Ed.]

Radial Nerve Injuries J Leonard Goldner and James M Kelley[6] (Duke Univ) present data on 63 patients with radial nerve injury Fracture of the humerus was the commonest single cause of radial paralysis (54%) X ray films of all patients with fractures of the humerus and radial nerve damage were reviewed and no correlation could be found between the degree of nerve damage and the characteristics of the fracture itself

A waiting period of 4-6 weeks as a guide for exploration of the radial nerve is considered optimum because a 1st-degree nerve injury will show signs of sensory and motor recovery within 6 weeks. If a 2d-degree injury has occurred a detectable advance of Tinel s sign should be apparent within 6-8 weeks enough time to permit contiguous surgery without risk of impairing bone union If there is evidence of sensory regeneration a longer waiting period may be warranted since some patients in this group recovered completely without sign of motor recovery for 20 weeks

In 25 of the 63 patients no operations were done 14 recovered completely and 7 partially One showed no improvement and 3 failed to return for follow up

(6) South. M J 51 873-883 J ly 1958.



Fig 127 —Three months after operation following removal of plaster Outline of radial graft extending from radiu into capitat is observed on anteroposterior and lateral views. (Courtesy of Stein I: Surg Gynec. & Obst. 106:231-232, February 1958.)

cut back at the proximal palmar crease to assure free finger motion.

This graft affords stability of cortical bone combined with wide apposition of cancellous or trabecular surfaces It also affords a shape that conforms to the desirable angle of wrist dorsiflexion after fusion The results are illustrated in Figure 127

Do s and Don ts in Treatment of Hand Injuries. Burton C. Kilbourne and Eudell G Paul[8] (Univ of Illinois) reviewed the records of 699 patients hospitalized because of hand injuries incurred at work.

After preliminary peripheral examination an open wound may be inspected (not explored) if sterile precautions are used An x ray is taken In the operating room the wound is cleansed gently with soap and water and irrigated with physiologic saline Complete exploration is accomplished, with incisional exposure as indicated. All foreign bodies and devitalized tissues are sharply excised. The viability of skin flaps is ascertained by noting the color of the skin presence of bleeding absence of subcutaneous fat and width of the base of the flap When seen within the first 12 hours all wounds

(8) S. Clin. North America 38 139-154 February 1958.

should be closed except human and animal inflicted lacerations and the rare laceration in which all gross contamination cannot be removed. Wounds produced by a grinding wheel require complete excision for the grind burns and embeds minute emery particles in all tissues it touches.

Of 116 lacerations 90 were closed primarily 12 with flaps and 24 with skin grafts Thick split grafts were taken with a straight razor or dermatome. Of the local grafts rotation and cross finger types are most useful For more extensive loss a pedicle is raised from the abdominal wall. Dressings are used to provide smooth even compression and the finger or hand is splinted.

Primary treatment of tendon and nerve injuries should consist in conversion to a clean wound suture of the digital nerves and skin closure. A flexion splint protects the nerve repair relaxes the joints and allows favorable wound healing After 6-8 weeks tendon continuity is restored by insertion of a segment of palmaris longus or toe extensor as a graft A midlateral finger incision provides exposure. Through several openings in the sheath the injured tendon segments are dissected out and the intact portions of the sheath are saved to serve as pulleys It is important to protect the volar capsule of the proximal interphalangeal joint. The segments of the superficial tendon distal to the neck of the proximal phalanx should not be removed. Leaving these slips to bridge the joint and become attached during postoperative splinting prevents the hyperextension deformity which may otherwise occur with loss of the superficial flexor When removal of a scarred sheath results in destruction of the retaining ligaments new pulleys must be provided by encircling the phalanx with a thin piece of tendon sutured to itself Failure to add such pulleys results in volar subluxation of the tendon on attempted flexion The graft is sutured to the stub of the deep flexor tendon at its insertion The proximal segments of the tendons are exposed through a transverse incision in the palm The proximal end of the graft is then guided through the sheath in the finger and into the palm The finger incision is closed. A length of graft is established which with the wrist at 180 degrees will flex the involved finger a little more than the resting flexion of the other fingers The anastomosis is completed and the palmar incision closed

Satisfactory primary repair of the severed deep tendon at the level of the middle phalanx can be performed when the injury is treated within 6 hours Immediate tenorrhaphy should not be attempted in the presence of great contamination or if more than ½ in of tendon has been lost Results are usually good though some loss of extension will accompany any shortening of the tendon Protective splinting should keep the wrist and finger joints in flexion for 3 weeks. Guarded active motion is then begun Passive stretching should be avoided for 5 weeks

Treatment of isolated superficial flexor tendon division in the finger consists in trimming the ends to avoid interference with deep tendon function Here again the distal segments should be trimmed just to the level of the neck of the proximal phalanx.

Partial division of the deep flexor tendon will require no suturing if less than one third of the fibers are involved approximation sutures and splinting are needed if up to two-thirds are cut and formal tenorrhaphy must be performed if more than two thirds are divided

The long flexor of the thumb can be repaired successfully as a primary procedure under conditions stated for the deep flexor of the fingers

Most extensor tendon injuries can be repaired primarily with expectation of a good result. Various simple suture technics are appropriate and except in the thumb extensors tension sutures are unnecessary Protective splinting is mandatory For lesions proximal to the metacarpal joints the wrist and metacarpophalangeal joints should be extended. Semiflexion of the middle and distal finger joints is desirable. For lesions over the proximal phalanx extension of the wrist and all finger joints is required

In the repair of nerves the ends must be freshened by a knife or razor blade to avoid crushing and to preserve the sheath In secondary repair the fibrous neuromas must be removed and the segments mobilized to attain length. Rotation is avoided and the ends are accurately approximated by peripherally placed 6-0 or 7-0 silk Tension is avoided by protective splinting for 2-4 weeks

The *sine qua non* of fracture or dislocation care is accurate reduction by closed or open methods and maintenance in a position of function Simple undisplaced fractures or frac-

tures which are stable after reduction should be splinted in position of function allowing active motion in all uninvolved digits It is frequently possible to discontinue immobilization after 2 weeks Dislocations should be reduced early and immobilized for 2 3 weeks in position of function Open reduction and repair of ligaments may be necessary For unstable displaced fractures positive internal fixation by suture intramedullary pin or small screw is preferred to traction unless comminution leaves no choice. Healing of a transverse fracture of the shaft or neck of the proximal and middle phlanges requires at least 5 weeks and often longer Intramedullary pins are useful in this fracture but must produce no distraction. The pins should splint the fracture for 4-6 weeks lest angulation recur

The universal hand splint is most useful for the provision of functional position and pressure dressings to the hand with multiple fractures. It is extremely important to be able to recognize the limitations of treatment of badly comminuted joints and attempt to gain a stable semiflexed digit rather than strive vainly for complete anatomic restitution

Primary treatment of fractures and severed tendons is directed toward reduction and stabilization of the fracture and provision of good skin coverage If the fracture involves the interphalangeal joints permanent restriction is anticipated The joint and fracture are pinned in semiflexion. The frayed torn or severed extensor tendon can frequently be sutured to add stability The purpose of this tenodesis is to restrict unopposed pull of the flexors which would produce an undesirable degree of flexion contracture. Where restoration of joint function is expected tendon suture is delayed until the fracture is healed and the joints are mobilized. If the lesion overlies the proximal phalanx a tendon graft is inserted.

In finger amputations thick split razor grafts are useful for finger tip loss The fingers are dressed with fluff gauze held with moderate pressure by Elastoplast. A curved aluminum splint insures more complete rest of the digit. When flaps are used in a distal phalanx with most of the nail bed destroyed the rest of the bed is removed to prevent troublesome horny spurs Flaps may be volar dorsal radial or ulnar and are trimmed neither too short nor too long A useless finger may be filleted to obtain skin for hand coverage proxi-

mal to the amputation stump A neuroma under the scar of the stump is disabling If amputation is carried through a joint the condyles are shaped carefully to prevent a bulbous end Tendons are cut short and allowed to retract. They are never sutured over the end of the bone Removal of the 2d or 5th metacarpal head leaves a more symmetrical hand. These bones should be beveled to avoid a tender prominent external margin

Infection is the most serious complication and occurs most often when seemingly insignificant lacerations are taken lightly It may destroy soft tissues or bone It is best prevented by early adequate care Antibiotics and tetanus antitoxin or toxoid are to be used in all badly contaminated wounds Hematomas produce excessive postoperative induration and scar tissue or may become infected. Careful hemostasis resilient fluff pressure dressing and correct splinting prevent hematoma formation Improper and prolonged splinting may result in unnecessary stiffening of the joints When a laceration crosses an important flexion crease, undesirable scarring and contracture may occur Primary transposition of flaps may be possible. If viability is questionable a secondary Z plasty is preferable. Delayed skin loss due to local circulatory failure is frequent It is an indication for early slough removal and skin graft.

► [The physician or surgeon who has not had some special training in the care of injuries to the hand should never undertake to treat such injuries The authors of this excellent and timely article have emphasized some of the errors made in treatment. The importance of careful, definitive cleansing of small lacerations to prevent infection, of the correct splinting of a hand in a position of function and of never splinting a finger in extension are effectively emphasized. The use of a compression dressing, carefully applied over an abundance of padding after a crushing injury to the hand prevents excessive edema and necrosis of tissues in most cases. —Ed.]

Urgent Surgery for Finger Flexor Tendon and Nerve Lacerations With Emphasis on Advancement of Divided Profundus Tendon Distal to Level of Laceration. According to Kenath H Sponsel[9] (Univ of Minnesota) injuries to the flexor surfaces of the fingers and thumb may divide the tendons of the superficial and deep flexor muscles damage the corresponding tendon sheaths or interrupt digital sensory nerves The effects on functions are devastating especially if both the profundus and the sublimis tendons have been cut,

(9) J A M A 167 1 1 2 M 29 1958.

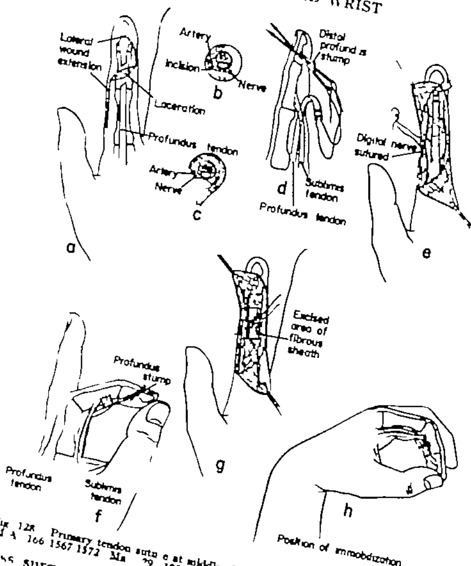


Fig 128 Primary tendon suture at middle phalanx. (Courtesy of Sponsel K. H. J A M A 166 1567 1572 Ma 29 1958)

unless surgical repair is successful Infection rough handling probing and too much dissection make for poor results When the surgeon encounters a contused or contaminated wound or is in doubt how to proceed he should cleanse the wound and close it without tendon repair After it is well healed a tendon graft can be performed

PROCEDURES —Preferred technic entails minimal handling of the tendon and tendon sheaths. Bleeding is minimized by a pneumatic tourniquet. The wound is irrigated with saline solution to free it from discoloration and blood.

Often it is desirable to drill a hole in bone for tendon fixation at the distal phalanx. The cutting type of straight skin needle is used as a drill point (Fig 128 *d*) It is placed in a regular type of hand drill

and drilled across the distal phalanx and out through the nail.

When it is necessary to extend the wound proximally and distally this is best done by extending the laceration to the lateral midline between the flexor and extensor surfaces (Figs 128 *a-c* and 129 *a-c*)

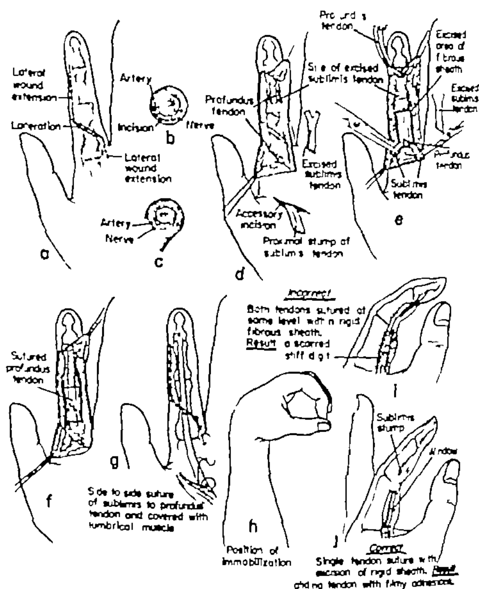


Fig 129 Primary tendon suture at proximal phalanx. (Courtesy of Spoesel, K. H. J A M A 1 67 1572 Mar 29 1958.)

The incision may be extended proximally laterally on one side of the finger and distally in the lateral midline on the other side. Adhesion of tendon to incision and flexion contracture result from extending the laceration longitudinally along the flexor surface of the finger. When the wound is extended, only the skin and the subcutaneous tissue superficial to the neurovascular bundle should be in-

cised (Figs 128 b and c and 129 b and c) Laceration in the proximal half of the finger leads to considerable retraction of 1 or both flexor tendons. Identification of the tendons may be necessary by transverse incision in the palm just proximal to the distal palmar crease (Fig 129 d)

When the laceration is within 1 in of the insertion of the profundus, the proximal end of the lacerated tendon should be advanced to the finger tip (Fig 128, a d f) In laceration of the middle third of the finger (Fig 128 g and h) the tendon should be sutured end to end or a short portion of the distal stump should be resected to the advance suture line and then an end to-end suture made. If there is laceration over the proximal phalanx with both the sublimis and the profundus tendons divided (Fig 129 a d g) excision of the sublimis and end to-end suture of the profundus should be done.

When urgent reparative surgery is undertaken with primary tendon suture, the sublimis tendon must be excised from its insertion to a point proximal to the tendon sheath in the palm (Fig 129 d and e) The sublimis and profundus tendons may be sutured side by side in the palm to give a two-muscle, one tendon finger (Fig 129 d and g) In an alternate method the sublimis tendon is pulled out of the laceration and the proximal portion cut and permitted to retract (Fig 129 c) Thereafter the profundus tendon is sutured. A broad window is removed from the tendon sheath in the area of suture. Excessive handling of the fibrous tendon sheath and the tendons in this area of so-called no man's land between the distal palmar crease and the level of the proximal interphalangeal joint leads to extensive scarring (Fig 129 i) Probing and dissecting in this area contribute to adhesion. Suture of both tendons at the same level leads to a single scarred tendon

Bulky dressings are applied. The wrist is flexed about 45 degrees and the finger flexed sufficiently to touch the thumb (Figs. 128 h and 129 h)

► [The suggestion made by Dr Sponsel that by locating the tendon sutures at levels other than the site of laceration adhesions and scarring with limitation of the gliding function of the tendon can be minimized is most practical.—Ed.]

Flexor Tendon Injuries of Fingers and Thumb Comparative Study Albert Van t Hof and Kingsbury G Heiple[1] (Grand Rapids Mich) review data on 60 tendon repairs in 52 patients in whom the technic of the Bunnell pull-out wire was used except in 2 instances in which the injury was outside the flexor tunnel All procedures were primary repairs and there were no infections Results were compared with 250 tendon repairs reported in the literature during the past 10 years Of the 250 tendon repairs 185 were in the flexor tunnel 32 outside the tunnel and 33 in the thumb

The method of Boyes was used for measuring flexor tendon function This determines the distance that the tip of the fin

(1) J Bone & Joint Surg 40-A:256-262 April, 1958

ger lacks in touching the distal palmar crease (Fig 131) In the thumb, the range of active and passive flexion of the terminal phalanx was measured (Fig 130) The percentage of complete motion represented in the comparative series of grafts was figured by comparing the degrees of active and passive motion Because some of the thumbs of the study patients had limitation in passive motion they were recorded as percentage of active motion as compared with the about

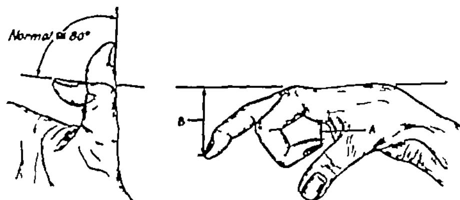


Fig 130 (left) —Method of measuring flexion of distal phalanx of thumb, which is about 80 degrees in most normal hands Frequency with which passive range was no greater than active range of motion seems to indicate that factors other than tendon function play important role in determining how much motion will be regained after injury

Fig 131 (right) —Method of measuring excursion of finger A distance that tip of finger lacks of touching distal palmar crease B, distance that finger lacks of complete extension. A plus B index of excursion (0-1 in. good 1-2 in., fair 2-3 in. poor over 3 in., failure)

(Courtesy of Van t H [illegible] A., and Helple K. G. J Bone & Joint Surg 40 A 256-262 April, 1958)

80 degrees of normal flexion at the distal joint This was transposed into per cent of normal flexion for comparative purposes

The study indicated that results of grafts within the flexor tunnel are distinctly better than those of primary repair The relatively poor results of primary repair seem to indicate that grafting procedures might be preferable in treatment of injuries within the flexor tunnel Results of primary repair outside the flexor tunnel and of the flexor pollicis longus are markedly better than those within the tunnel The shorter period of disability after primary repair apparently justifies the continued handling of injuries outside the flexor tunnel and of the thumb in this manner Grafting remains available for the severely traumatized wound or to correct the poor result

Tendon Transfers to Restore Function of Hands in Tetraplegia, Especially after Fracture Dislocation of the 6th Cervical Vertebra on the 7th Paul R. Lipscomb Earl C Elkins and Edward D Henderson (Mayo Clinic and Found) point out that many tetraplegic patients are injured between the 6th and 7th cervical vertebra. These patients have on one side and often on both function below the elbow of only the extensor carpi radialis longus extensor carpi radialis brevis brachioradialis flexor carpi radialis and pronator teres muscles

By two-stage surgical transfer of tendons in each upper extremity active extension and flexion of all digits correction of clawing and opposition of the thumb can be accomplished. These tendon transfers utilize the function of automatic motion of the fingers that accompanies wrist movement. Arthrodesis of the wrist rarely if ever should be done in patients with tetraplegia.

TECHNIC.—*Operation 1*—The extensor carpi radialis brevis is undisturbed to allow dorsiflexion of the wrist. On occasion a slip of the tendon of this muscle is transferred to the tendon of the abductor pollicis longus The Riordan tenodesis is done, when indicated to prevent hyperextension of the metacarpophalangeal joints and subsequent clawing of the fingers. The tendon of the extensor carpi radialis longus is transferred to the long extensor tendons of the fingers and thumb The tendon of the extensor pollicis longus may be relocated so that it pulls straighter over the base of the first metacarpal.

Operation 2—The flexor carpi radialis lengthened by means of the tendon of the palmaris longus or one of the sublimis muscles, is transferred, and a fixed pulley made from the tendon of the flexor carpi ulnaris is used to restore opposition of the thumb (Fig 132) The pronator teres lengthened by means of a strip of attached periosteum or a tendon of the flexor digitorum sublimis is transferred to the flexor digitorum profundus tendons of the fingers The brachioradialis tendon is transferred to the flexor pollicis longus

The patients undergoing this surgery require only light general anesthesia which they tolerate without undue risk

If a Riordan tenodesis is done at the first operation the wrist should be splinted in full extension the proximal finger joints in slight flexion and the middle and distal joints in extension If a Riordan tenodesis is not done the metacarpophalangeal joints are extended The dressings should be left for 4 weeks.

The patients are then taught to extend the fingers using the transferred extensor carpi radialis longus It is important

(2) J Bone & Joint Surg. 40-A 10 1 1080, October 1958

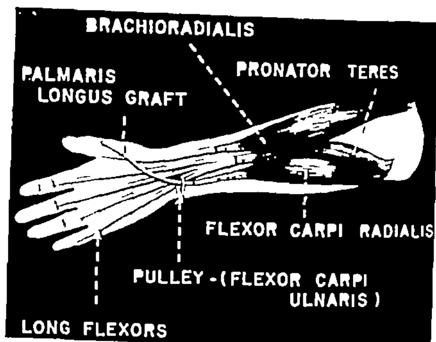


Fig 132 (Courtesy of Lipscomb, P R., et al J Bone & Joint Surg 40 A 1071 1080 October 1958)



Fig 133 (Courtesy of Lipscomb, P R., et al J Bone & Joint Surg 40 A 1071-1080 October 1958)

that passive stretching be avoided Between the two surgical procedures patients are encouraged to be as active as possible Usually 2 months after the first operation the joints have been sufficiently mobilized for the second surgical procedure to be done After this the wrist is splinted in flexion and the fingers in the position of function for 4 weeks. The patient is then taught to flex and extend the fingers and to oppose the thumb (Fig 133)

Toe-to Thumb Transplant with Nerve Graft is described by R. Chandler and Patrick Clarkson[3] (Basingstoke Plastic Centre London)

Man, 21 lost his left thumb in an accident. The thumb had been amputated through the base of the proximal phalanx. Two flaps were delayed on the dorsum of the foot (Fig 134) The first circumscribed an area of skin around the base of the left great toe. The second outlined a large area on the outer side of the dorsum of the foot. This flap was planned as a cover for the head of the first metatarsal In about 2 weeks, further delay of the foot flaps was done, and 3 weeks later a flap was raised from the base of the left thumb stump to expose the base of the proximal phalanx and the metacarpal head The tendon of the left flexor hallucis longus was identified through an incision beneath the medial malleolus and divided. The flap surrounding the base of the great toe was raised and the long extensor tendon was identified and divided. The left hand was brought into contact with the great toe (Fig 135) the capsule of the metacarpophalangeal joint of the toe having first been opened to draw up the divided long flexor tendon and attach it in the thenar region. The extensor tendon was sutured to the extensor pollicis longus tendon at a level of 2 in. proximal to the wrist joint. The flexor hallucis longus was not sutured. The flaps were joined, and the raw area on the dorsum of the foot was covered by a free dermatome graft.

After 3 weeks, the digital nerve on the lateral aspect of the great toe was exposed and divided, about ½ in. of the length of the nerve being tucked under the distal skin flap The digital vessels on this side were also divided. A week later the incision from the dorsal flap of the foot was continued around on the undersurface of the great toe thus completing circumferential delay The digital nerve on the medial side was divided and about 1 in. of its length tucked under the distal skin flap After 2 more weeks, the delaying incisions around the great toe were opened and the toe completely freed from the foot. The defect on the foot was closed by the previously delayed flap from the outer side of the dorsum of the foot, to cover the head of the metatarsal and by a free graft for the rest of the dorsum. After transfer of the toe onto the thumb stump the anterior defect on the thumb was closed by a free skin graft. Convalescence was somewhat stormy because of infection.

After 3 more weeks, some small necrotic portions of the proximal toe phalanx were nibbled away The head of the metacarpal of the thumb was also "freshened," the two bones were brought into apposition and the skin incision closed. Fixation was carried out by plaster of paris splints.

The patient made satisfactory progress and no complications occurred apart from minor marginal necrosis of the hand and foot flaps. The transplant was successful cosmetically with pronounced functional improvement. There was still some lateral angulation at the metacarpophalangeal joint, but this enabled the patient to grip large objects.

(3) Am. J Surg 95 315-31 February 1958







Fig 134 (above left)—First foot flap, proximal to base of hallux, is for transfer Long lateral flap is to provide cover of distal stump. Both are "delayed."

Fig 135 (above)—Hand-foot attachment under dorsal foot flap and with dermatome graft to secondary dorsal foot defect.

Fig 136 (left)—Final result, showing fine pinch between index finger and thumb, and reasonable matching in size and shape that transferred big toe gave.

(Courtesy of Chandler R and Clarkson P Am J Surg 95:315-317 February 1958)

Later the thumb web was opened by an incision running along the thenar crease. The digital nerve to the thumb was located and the divided stump of the digital nerve to the toe was dissected out. The 7 cm. gap separating these two ends was bridged by a graft taken from the superficial radial nerve. About 6 weeks later under tourniquet, the shaft of the 1st metacarpal was exposed through a radially placed incision and arthrodesis was performed between the proximal toe phalanx and the head of the metacarpal Fixation was carried out with Kirschner wires and plaster of paris splints.

Three months after the nerve graft there was some patchy return of light touch over the medial side of the pulp The transfixing wires of the arthrodesis were in position The metacarpophalangeal joint was slightly flexed, but allowed full abduction for gripping big objects and also opposition of index pulp to "thumb" pulp for the picking up of small objects (Fig 136) The passive range of the interphalangeal joint was 175-165 degrees.

► [The authors are not correct in assuming that the 1st toe is of relative unimportance. The technic that they have developed and demonstrated and the results they have obtained are commendable. However transposition of the index finger to replace an absent thumb has been a satisfactory procedure and should be the operation of choice.—Ed.]

Congenital Anomalies of Hand Part II In considering the surgical management of these anomalies H Kelikian and Ara Doumanian[4] (Chicago) point out that of the 5 metacarpal bones the 1st has the greatest range of motility and the 5th the next greatest range The 4th can also be made to move to a degree the 2d only slightly and the 3d not at all If the 1st, 5th and 4th metacarpals are separated from the adjoining metacarpals and covered with skin they will function as short stubby fingers In hands in which this has been done the 3d metacarpal is also wrapped with skin for although it cannot be made to move, it can be used as an appositional strut If the 2d metacarpal bone is resected the web space between the 1st and 3d metacarpals will be widened increasing the relative length of the separated rays on the radial side of the hand Excision of the 2d metacarpal provides enough skin to cover the entire 1st metacarpal as well as the radial surface of the 3d metacarpal Skin from the back of the 4th metacarpal ray is used to cover the 5th metacarpal and the resulting denuded area is lined with skin from a pedicled graft from the abdomen

To separate the 4 ulnar metacarpals the webs between them are deepened and the transverse metacarpal ligament is severed in the process (Figs 137 and 138) The clefts thus

(4) J Bone & Joint Surg 39-A 1249-1266, December 1957

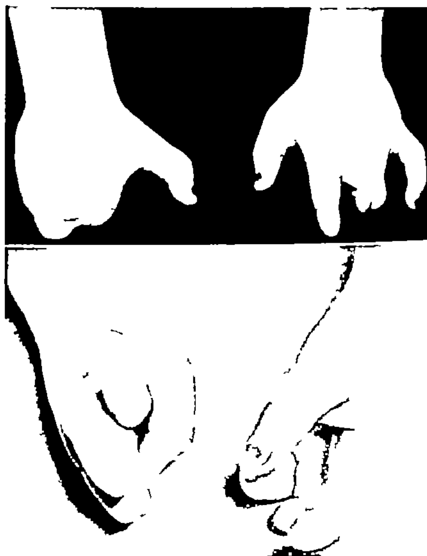


Fig 137 (top) —Bilateral congenital anomalies in girl, 4 before surgery
Fig 138 (bottom) —Same hands after reconstructi[ve] surgery
(Courtesy of Kelikian H., and Doumanian, A. J Bone & Joint Surg 39 A 1249-1266, December 1957.)

created may extend for two-thirds the length of each metacarpal [illegible] the 1st and 4th intermetacarpal spaces are deeper than the others The uncovered surfaces of the surgically deepened [illegible] spaces are lined partially with local integument but mainly with skin supplied by the pedicled graft. Since the skin of the pedicled graft is devoid of sensation, it should not be used to cover the volar surfaces. The palmar skin overlying the metacarpal bones is left intact The transplanted skin is used to cover defects in the web spaces and

also to cover the adjacent and dorsal surfaces of the metacarpal rays

The thumb is considered to be the most useful digit. When judiciously shifted radialward and turned to face the other digits the index finger which is equipped with sensory nerves blood vessels tendons and muscles may serve as a physiologic substitute for the missing thumb

METHOD.—The first operation consists in deepening and widening the web space between the index and long fingers and covering the resulting cleft with a graft containing areolar tissue. The pedicled graft is lifted from the abdomen and the web space between the index and long fingers is opened, maintaining adequate pneumatic constriction of the arm. The skin incision may be started on the palm or back of the hand. The volar incision is begun just proximal to the distal palmar crease at a point in line with the central axis of the long finger It is extended radialward, parallel to the palmar crease, and turned distally to bisect the web between the index and long fingers. It is then continued dorsalward in the cleft between the 2d and 3d metacarpals ending at a point 1 in. or more proximal to the interdigital web. The connected dorsal and palmar incisions sever 3 binding structures the junctura tendinum that connects the extensor tendons of the index and long fingers, the interlacing fibers of the palmar aponeurosis and the transverse metacarpal ligament that binds the heads of the 2 metacarpals. Distal to the bifurcation of the common arterial trunk, the digital artery along the radial side of the long finger is ligated in 2 places and severed between the 2 ligatures. The branches of the median nerve supplying the adjacent surfaces of the index and long fingers need not be disturbed for they separate from the main trunk more proximally If the adductor pollicis is present the distal fibers of its transverse head are stripped from the 3d metacarpal to deepen the surgical cleft behind the median nerve. The dissection is then carried deeper into the palm toward the wrist, along the interspace between the volar interosseus of the index finger and the dorsal interosseus on the radial side of the long finger The index finger is abducted radially as far as possible the pneumatic constrictor is deflated and hemostasis secured. The freed petal of the abdominal graft is applied to the wound between the 2 fingers and secured with interrupted wire sutures. A catheter made rigid by insertion of a Kirschner wire is anchored to the nails of the long and index fingers and then bound to the body with a Velpeau bandage.

The second operation is usually performed about 7 weeks later The end of the pedicle of the graft attached to the abdomen is freed, the incision on the palm is retrenched and extended ulnarward and the skin of the graft stem is flattened into the palm and sutured. A second incision is made on the back of the wrist, extending along the ulnar border of the index metacarpal which is then osteotomized at the junction of its middle and proximal thirds. From the abducted position the index finger is rotated until its volar surface faces the corresponding surface of the ring finger The fragments of the osteoto-

mized index metacarpal are then secured together with a loop of malleable wire. Since, to function efficiently the thumb should be shorter than the other fingers the distal fragment of the metacarpal is invaginated into the proximal fragment. Later it may even be necessary to arrest the growth of the epiphysis at the distal end of the metacarpal. The occasional proximal epiphysis in an index metacarpal may also have to be arrested. Through a small incision over the back of the wrist, the dorsal carpal ligament is split and the extensor tendon is extricated from the wound and shifted to the lateral side of the

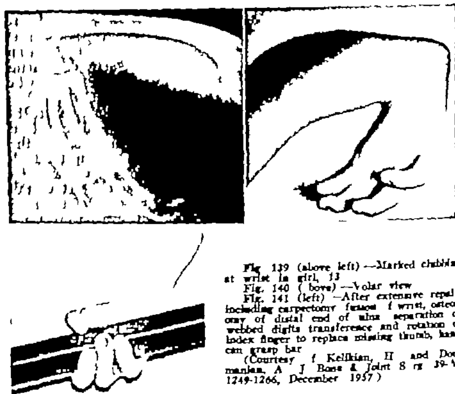


Fig. 139 (above left) —Marked clubhand at wrist in girl, 13

Fig. 140 (above) —Volar view

Fig. 141 (left) —After extensive repair including carpectomy fusion of wrist, osteotomy of distal end of ulna separation of webbed digits transference and rotation of index finger to replace missing thumb, hand can grasp bar

(Courtesy of Kelikian, H and Doumanian, A J Bone & Joint S 39-A 1249-1266, December 1957)

radius where it is held by a sling fashioned from part of the tendinous insertion of the brachioradialis. The incisions are closed, a Kirschner wire is passed through the distal phalanx of the rotated and abducted index finger and a below the-elbow cast is applied. The wire is removed only after the fragments of the osteotomized metacarpals have completely united. During immobilization functional exercises of the other digits, the elbow and the shoulder are encouraged

It is not possible to consider uncomplicated club hand deformities in the same category as uncomplicated soft tissue contractures or uncomplicated club-foot deformities Except in infants with arthrogryposis athetosis or cerebral palsy a hand is seldom twisted into an awkward position at birth without an accompanying deformity The deformity may be

a missing digit or 2 fingers bound together In some children, the radius or ulna is absent

In children the authors corrected the deformity of a missing forearm bone at the wrist by periodic osteotomies of the radius or ulna or of both if both were present (Figs 139 141) The osteotomy is done proximal to the distal epiphysis of the bone and an attempt is made to correct the deformity around both axes (anteroposterior and side to-side) of the wrist. The purpose is to place the hand in a position of 10-20 degrees of dorsiflexion and slight ulnar deviation. If the flexion deformity at the wrist is marked abrupt correction may overstretch the nerves and damage the blood vessels The correction should be done gradually In some instances it may even be necessary to wait until the patient is age 10 At that age carpectomy can be done to allow the wrist to shift into a more normal position A year or two later the wrist may be stabilized by fusion In surgical ankylosis of the wrist the distal inch of the ulna (if this bone is not missing) should be resected to permit pronation and supination of the forearm and of the hand When only the ulna is present, clubbing at the wrist is treated by carpectomy fusion and if necessary osteotomy When clubbing at the wrist is accompanied by absence of the thumb or webbing of the fingers digital insulation or substitution of the index finger for the missing thumb may be done simultaneously with correction of the wrist deformity

► [The excellent functional results obtained in the cases presented here, including the transposition operation to create a thumb where none was present at birth, are most commendable. Pinch, grasp and thumb action were restored in each instance.—Ed.]

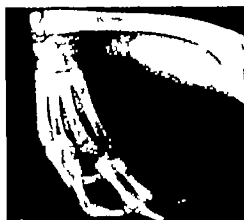
Repair of Congenital Finger Syndactylia in 19 patients with 44 webs is described by Bengt Nylén[5] (Uppsala) The following modified Bunnell procedure was used in 28 webs.

TECHNIC.—Full thickness skin grafts from the inguinal region were used to cover the defects of the fingers. Recently to avoid scar contraction on the fingers, the incision line has been broken by small transverse cuts on the volar and dorsal sides, corresponding to the proximal and distal interphalangeal joints (Figs. 142 and 143) The grafts were sutured with 5-0 catgut in all children under age 8 A pressure dressing was applied for about 10 days, leaving the finger tips free for inspection After the first dressing a small bandage was worn for about 5 days. No splints were used in the postoperative period.

Follow up examination of the 28 webs showed good re

(5) Acta chir scandinav 113:310-318 1957

mized index metacarpal are then secured together with a loop of malleable wire. Since to function efficiently the thumb should be shorter than the other fingers the distal fragment of the metacarpal is invaginated into the proximal fragment. Later it may even be necessary to arrest the growth of the epiphysis at the distal end of the metacarpal The occasional proximal epiphysis in an index metacarpal may also have to be arrested Through a small incision over the back of the wrist, the dorsal carpal ligament is split and the extensor tendon is extricated from the wound and shifted to the lateral side of the





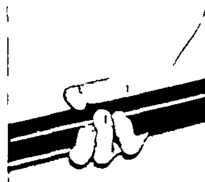


Fig 139 (above left) —Marked clubbing at wrist in girl, 13

Fig. 140 (above) —Volar view

Fig 141 (left) —After extensive repair including carpectomy fusion of wrist osteotomy of distal end of ulna, separation of webbed digits transference and rotation of index finger to replace missing thumb, hand can grasp bar

(Courtesy of Kelikian, H and Doumanian A. J Bone & Joint Surg 39 A 1249 1266, December 1957)

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a missing digit or 2 fingers bound together In some children the radius or ulna is absent.

In children the authors corrected the deformity of a missing forearm bone at the wrist by periodic osteotomies of the radius or ulna or of both, if both were present (Figs 139 141) The osteotomy is done proximal to the distal epiphysis of the bone and an attempt is made to correct the deformity around both axes (anteroposterior and side to-side) of the wrist. The purpose is to place the hand in a position of 10-20 degrees of dorsiflexion and slight ulnar deviation If the flexion deformity at the wrist is marked abrupt correction may overstretch the nerves and damage the blood vessels The correction should be done gradually In some instances it may even be necessary to wait until the patient is age 10 At that age, carpectomy can be done to allow the wrist to shift into a more normal position A year or two later the wrist may be stabilized by fusion In surgical ankylosis of the wrist the distal inch of the ulna (if this bone is not missing) should be resected to permit pronation and supination of the forearm and of the hand When only the ulna is present clubbing at the wrist is treated by carpectomy fusion and if necessary osteotomy When clubbing at the wrist is accompanied by absence of the thumb or webbing of the fingers digital insulation or substitution of the index finger for the missing thumb may be done simultaneously with correction of the wrist deformity

► [The excellent functional results obtained in the cases presented here, including the transposition operation to create a thumb where none was present at birth, are most commendable. Pinch, grasp and thumb action were restored in each instance.—Ed.]

Repair of Congenital Finger Syndactylia in 19 patients with 44 webs is described by Bengt Nylén[5] (Uppsala) The following modified Bunnell procedure was used in 28 webs

TECHNIC.—Full thickness skin grafts from the inguinal region were used to cover the defects of the fingers. Recently to avoid scar contraction on the fingers the incision line has been broken by small transverse cuts on the volar and dorsal sides, corresponding to the proximal and distal interphalangeal joints (Figs 142 and 143) The grafts were sutured with 5-0 catgut in all children under age 8 A pressure dressing was applied for about 10 days leaving the finger tips free for inspection After the first dressing a small bandage was worn for about 5 days. No splints were used in the postoperative period.

Follow up examination of the 28 webs showed good re-

(5) Acta chir scandinav 113 310-318 1957

sults in 23 Fingers had normal movements There was a deep almost normal looking commissure and no scar contraction The full thickness skin grafts were well healed, with a good texture and generally a good color match. In a few patients however the grafts were slightly more pigmented than normal skin In 1 of the other 5 webs there was a slight scar contraction in 1 finger 7 years after surgery This did not require further operation nor did another web examined 2 years postoperatively with a minor scar contraction at the dorsal base of the commissure The other 3

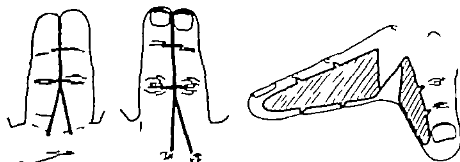


Fig. 142 (left) —Incisions of web. Note small transverse cuts on volar and dorsal sides.
Fig 143 (right) —V-shaped dorsal and volar flaps forming lining of commissure and full-thickness skin grafts covering defects of fingers.
(Courtesy of Nylén B : Acta chir scandinav 113:310-318, 1957)

webs were observed in 2 patients One a boy aged 8 had cutaneous syndactylia on the left hand between the 2d and 3d fingers and 3d and 4th fingers with congenital abnormal growth of phalangeal bones including symphalangism He was operated on at age 1 year with separation of the fingers in two stages The defects of the lateral sides of the fingers were partially sutured and the remaining area covered with full thickness skin grafts After operation severe hypertrophic scarring developed on the middle and ring fingers Two years later the scar was excised, with full thickness skin grafting of the resulting defects After 5 years there was still some shortness of skin on the volar side of the fingers which will require further surgical correction. The grafts were well healed and the commissure between the 2d and 3d fingers was somewhat shallow although finger movements were not decreased

The second patient, a boy aged 7 had syndactylia between

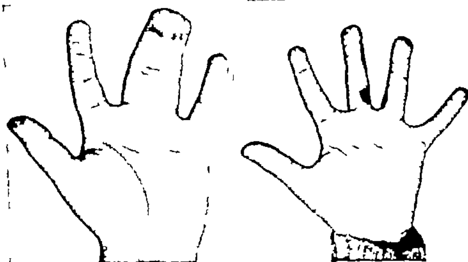


Fig 144 (left).—Preoperative condition.
Fig 145 (right).—Same hand 2 years after second operation, showing well-healed commissure and full range of movements. Note full-thickness skin grafts on fingers, rather markedly pigmented.
(Courtesy of Nylén, B : Acta chir scandinav 113 310-316 1957.)

the 3d and 4th fingers on both hands on the left, a complete fibrous web and on the right a web reaching distally to the proximal interphalangeal joints The left hand had been operated on at age 4 by the Bunnell technic, and hypertrophic scar contraction had developed on the volar side of both middle and ring fingers Four months later excision of the hypertrophic scar and release of the skin shortness by Z plasty were carried out. Follow up examination 2 years later showed well healed normal looking commissure and well-healed skin grafts with normal movements of both fingers (Figs 144 and 145)

► [Good end results in operations for finger syndactylia are rarely obtained when the patient is under 3 The technic described by Nylén is practical, and his results are excellent. His theory that immobilization of the entire musculotendinous expanse in the relaxed position is essential in treating mallet finger injuries is logical, and he has demonstrated the effectiveness of this principle.—Ed.]

Deformities of Hand James T Mills[6] (Dallas) repairs congenital syndactylia involving the hands when the patients are about age 1½ 2 In most instances some skin grafting is necessary but in others a very good result may be obtained by multiple Z plasties A good end result allows complete extension and flexion of the involved fingers with a deep and as normal a web between the fingers as possible.

(6) Am. J Surg 95 189-193 February 1958.

Repair of the simple skin web deformities is easily done. There are instances when some joint changes may be produced in the fingers because of a bony union between the involved fingers that had not been cared for earlier

Prevention of marked deformities about the hands is of utmost importance Intensive care and cleansing of the wounds as early as possible and immediate surgery will greatly cut

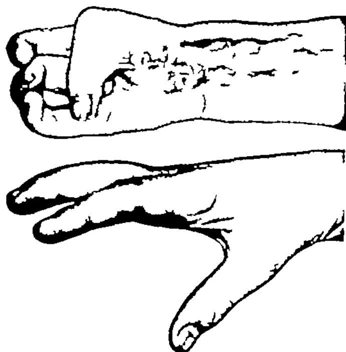


Fig 146 (top) —Severe contracture deformity due to burn.
Fig. 147 (bottom) —Final result with good extension and flexion (all fingers in same patient.
(Courtesy of Mills, J T: Am. J Surg. 95 189 193 February 1958)

down the number of such deformities as well as subsequent joint changes resulting in good or better functional outcome in a shorter period.

Figure 146 is an example of a hand deformity with marked contracture of the thumb and fingers resulting from an extensive burn The thumb was almost carried across the palmar surface by the pronounced scar contracture and there was complete contracture onto the palmar surface of the 3d finger Contractures were also present about the 2d and 4th fingers Prolonged postoperative physical therapy could have been prevented had the surgery been performed many months earlier Usually some joint changes are found in

these cases with fibrous union at the joints due to the long delay in repair of the deformity This patient now has a good functional hand (Fig 147)

The most extensive burns involving the hands usually occur on the dorsal surfaces of the fingers, hands, wrists and arms In these deeper burns a thick scar usually results preventing to a great degree thumb and finger flexion Even when only 1 hand is involved early surgery is indicated

Congenital Syndactylism of Fingers J Hiram Kite[7] (Atlanta Ga.) treated 86 patients born with syndactylism of the fingers Involvement was unilateral in 41 and bilateral in 45 a total of 131 hands with webbed fingers The fingers were normal in appearance in 45 and complicated in 41 patients Syndactylism was inherited in 21%

If the fused fingers are of unequal length, as when the 4th and 5th fingers are fused to the ends they should be separated early to permit growth of each finger This may be done at age 6 months If they are of the same length the operation may be postponed until the child is several years old.

PROCEDURES.—Some patients show a web only slightly higher in its attachment than normal This may interfere only with playing the piano or fitting gloves If the web extends to the proximal interphalangeal joint it becomes a physical handicap. The best treatment is a Z incision with transposition of the flaps An incision is made along the rim of the web between the fingers and the web separated into 2 leaves. The arms of the Z extend from the end of the incision to the base of the fingers on the dorsal and palmar surfaces and the flaps are reversed and sutured into place.

When the fingers are fused to the ends successful operation demands formation of a satisfactory commissure between the fingers. A useful method is raising of a long dorsal flap After the fingers have been separated, the flap is drawn forward across the commissure and sutured to the skin of the palm. This is probably done best by Bunnell's pantaloon method. A pointed volar flap is raised to fit into the notch thus a suture line paralleling the web is avoided. Alternatively a triangular flap may be raised from the dorsal and another from the volar surfaces of the fingers extending from near the proximal interphalangeal joints to the base of the fingers. The dorsal flap is the larger Both flaps are drawn through the commissure and sutured side by side in the form of a Z.

To avoid contractures of the suture line and keloid formation zigzag flaps of skin are cut on both volar and dorsal surfaces It is a little difficult to make these fit accurately into each other In separating the 3d and 4th fingers, the volar interphalangeal creases are on the same level and the flaps are cut at about an equal distance apart.

When the 4th and 5th fingers are to be separated, the volar creases

(7) South. M J 51 160-164 February 1958.

are at different levels Here an effort is made to take the flap of skin from the other finger opposite the volar crease, to prolong the skin at the joint level. This is easy to plan on the volar surface. Two needles are then inserted from the palmar to the dorsal surface to form guides for the flaps on the dorsal surface. When the skin is loose between

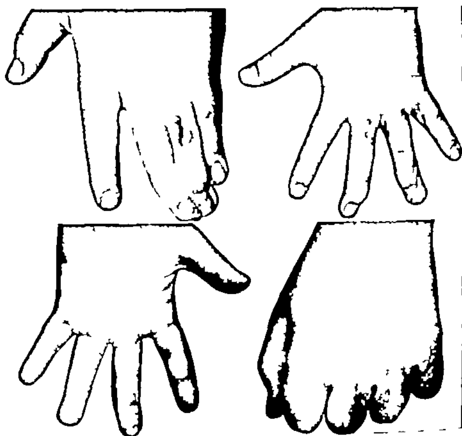


Fig 148 (top left) —Last three fingers were fused and nails of middle and ring fingers united.

Fig 149 (top right) —Fingers were separated by two operations and by use of dorsal skin flap and whole-thickness skin grafts. In separating fused nails, edge of nail and narrow strip of matrix were removed to reduce nail to normal size.

Fig 150 (bottom left) —On palmar surface commissures are at usual level, but not as wide as if dorsal and palmar flap had been used.

Fig 151 (bottom right) —Commissures at normal level posteriorly giving natural appearance to hand.

(Courtesy f Kite, J H. South. M. J 51 160-164 February 1958.)

the fingers, these flaps may fall into place and be sutured without tension. If the fingers are tightly fused, a skin graft is needed. A whole-thickness graft is best, because there is less contracture and it stands up better under use The groin is probably the best donor area, because the skin is loose the wound easily closed and the scar less conspicuous. A graft must always be placed over the dorsum of each finger to cover the area left by removal of the flap If the distal phalanges

are united by bony union and these must be separated with a chisel, the graft should extend to the end of the fingers because there will not be enough skin for closure and the bone will not heal well if exposed to infection from granulation tissue If 1 or 2 small grafts are used to cover the areas on the sides of the fingers where the skin can not be closed, the end of the sutures for the grafts are left long and tied over a small sponge for pressure. Only one side of a finger should be operated on at a time to avoid injury to the circulation

If the nails are grown together the cut edges plus a small strip of the nail bed should be removed to narrow the nail (Figs 148-151) Otherwise there will be a troublesome and unsightly nail edge.

The fingers are dressed by applying petrolatum gauze over the grafts and winding a small roll of gauze around the fingers A sponge is inserted between the fingers to hold them comfortably apart. The two fingers are then bandaged together A splint may be used but when the sponge becomes dry it is firm and gives good immobilization to the fingers. The stitches are removed in a week and the grafts dressed with wet dressings or ointment. Healing is usually complete in about 3 weeks

► [Most hand surgeons and plastic surgeons who have had experience in treating congenital syndactylism of the fingers have advocated delaying surgery until the child is at least age 3 years. Some prefer to defer definitive treatment until the patient is 6 or 7 Most operations performed during early infancy have had to be revised later Dr Kite, a meticulous surgeon, has shown that it is possible to treat this condition adequately in early infancy if the technic is carried out with great care and whole-thickness skin grafts are used to cover the denuded areas.—Ed.]

Congenital "Windmill Sail" Deviation of Fingers involves both hands symmetrically and is characterized by ulnar abduction of the fingers a particular relation between the position of the thumb and index finger and absence of symptoms that could explain the deviation morphologically or functionally The syndrome has a familial incidence and is accompanied by other endogenous malformations

August Rutt[8] (Univ of Cologne) reports 2 cases of this condition.

CASE 1 —Boy 15 with 7 siblings and parents who were well had flat feet and malposition of both thumbs since birth For the latter condition he was operated on unsuccessfully at age 6 months. Later the finger deformity became more evident. Except for his hands and feet, the physical findings were negative. Both hands showed the same characteristics which were somewhat more pronounced in the right hyperextension of the hand, considerable adduction of the thumb hyperextension of the end phalanx and a short interdigital web extending almost from the height of the interphalangeal joint of the

(8) Arch. orthop. u. Unfall-Chir 49:387 391 1957

thumb to the metacarpophalangeal joint of the index finger The web was so tight that it did not allow any abduction or opposition of the thumb The other fingers showed flexion contracture and ulnar abduction contracture in the metacarpophalangeal joints. The other digital joints were free. X rays revealed besides malposition of the fingers,

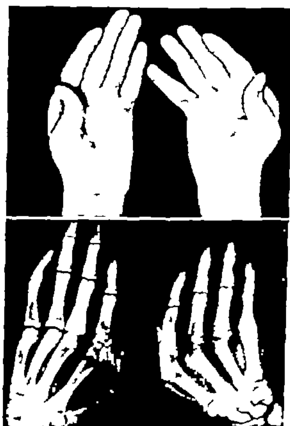


Fig. 152.—Hands of boy, 15, showing deviation of fingers and adduction of thumbs. (Courtesy of Rött, A.: Arch. orthop. u. Unfall Chir 49 387 391 1957)

a slight slanting of the caudal epiphyses of the metacarpal bones (Fig 152)

The tense interdigital web between the thumb and index finger on the left hand was relieved by the formation of two Zeller skin flaps. Redressement was done on the other fingers. The early success of the operation could not be maintained. The untreated hand deteriorated further

CASE 2.—Girl 9 sister of boy in Case 1 had had flat feet and malposition of the thumb since birth, with slowly developing malposition of the other fingers. The hands showed the same characteristics as her brother's, but the defects were less pronounced. X rays revealed malposition of the fingers and a slight slanting of the proximal epi



Fig 153 — Hands of sister 9, showing simila congenital deformity but less pronounced deviation (Courtesy of Rütt, A Arch. orthop u. Unfall-Chir 49 387 391 1957)

physial line of the metacarpal bones (Fig 153) Surgery similar to that performed on her brother was done on her right hand and parts of the adductor pollicis muscle were severed. Though this additional surgery contributed to slightly better results eventually the condition of both hands deteriorated.

Treatment of Mallet Finger by Complete Metacarpophalangeal Flexion is evaluated by Thomas D Hall and Alzir B Alves[9] (Chicago) The mallet finger is a result of an avulsion of the extensor slips of tendon or an avulsion chip fracture of the dorsal and proximal portion of the phalanx with the attached tendon In many patients it is only a cosmetic problem In others whose occupation or other activities require manual dexterity the deformity presents an additional imposing functional problem

Irrespective of the presence or absence of a bone fragment

(9) Surg Gynec. & Obst. 106 233-237 February 1958.

the pathologic condition is essentially the same There is disruption of the continuity of the musculotendinous mechanism The immobilization most popularly used is phalangeal which is limited to only the tendinous expanse of the interphalangeal extensor mechanism and disregards the muscular expanse. A *cardinal principle in treatment of tendon injuries* by closed or open measures is immobilization of the complete musculotendinous mechanism in the relaxed position The relaxed position of any musculotendinous

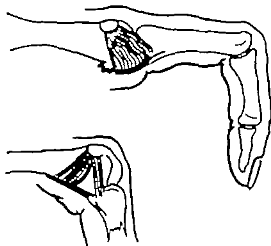


Fig 154—Capsular ligaments of metacarpophalangeal joint are relaxed in *extension and taut in flexion*. Contracture not probable when finger is in flexed taut position (Courtesy of Hall, T D., and Alves, A. B Surg., Gynec. & Obst. 106 233-237 February 1958.)

structure is the position that most closely approximates the site of origin and the insertion Complete relaxation of the interphalangeal extensor mechanism therefore cannot be obtained without metacarpophalangeal flexion

The authors have never observed a *flexion contracture of the metacarpophalangeal joint resulting from prolonged immobilization* and have no knowledge of its occurrence. The high incidence of extension contractures at this site and the apparent infrequency or absence of flexion contractures are explainable on the basis of *capsular anatomy (Fig 154)* When extended the capsular ligaments are relaxed to permit abduction and adduction of the finger immobilization in this position may result in shortening of these ligaments and consequent extension contracture When flexed *the capsular ligaments are taut* and no shortening can occur In all

their patients the authors used a simple modification of the Bunnell pull-out wire procedure

TECHNIC.—The extensor tendon was shortened several millimeters a procedure believed to have a twofold advantage It freshens the end of the avulsed tendon and removes any laxity from the extensor mechanism Instead of the wire being inserted through the end of the tendon, as illustrated by Bunnell it was brought out on top of the tendon in order to avoid the presence of the wire at the site of the healing and also to approximate the tendon better to the site of avulsion The sutures were kept throughout the entire 5 weeks of immobilization This procedure resulted in eliminating a cast change. No complications were thus encountered. Before closure of the wound, the wire was tested to assure stability of the suture and to observe the approximation of the tendon end to the base of the phalanx Tying of the wire suture was done after the cast was applied which obviated possible breaking of the wire suture

A variety of technics with plaster of paris immobilization were found satisfactory It was advantageous to maintain the desired position during cast application by applying tape, moleskin or collodion stripping from the palmar surface of the middle and distal phalanges, across the tip of the finger and then with tension to the dorsum of the proximal phalanx. After the cast application, the stripping was sectioned to release excess tension A beveled piece of felt was placed in the palm to maintain hyperextension With surgical repair the cast applied permitted visualization of the distal phalanx and attachment of the wire to the nail. In closed cases visualization was not found necessary

The authors treated 14 mallet fingers in 11 patients Those patients seen for a considerable period after treatment had no appreciable alteration of the results observed 4-6 weeks after immobilization was discontinued Eight fingers were examined more than 3 weeks after injury and were treated by primary operative repair and immobilization. Six fingers were examined less than 3 weeks after injury and were treated by the closed method Only 5 of these 6 fingers were available for study 2 of which required subsequent surgery because of unacceptable results thus raising the total of operative cases for study to 10 One of the 3 patients successfully treated by the closed method had a normal range of flexion and extension the other 2 had flexion and extension to over 170 degrees

All 10 patients treated surgically were improved to a worthwhile extent, possessing active finger flexion and extension 2 had normal hyperextension 3 extension to 180 degrees 3 to about 170 degrees and the other 2 to slightly under 170 degrees

Although the pull-out wire sutures remained during the entire immobilization period no infections occurred.

► [The principle demonstrated includes immobilization of the entire musculotendinous expanse in a relaxed position, with immobilization of the metacarpophalangeal joint in flexion. The results reported are excellent.—Ed.]

Replacement Arthroplasty in Military Patients Earl W Brannon[1] (Lackland Air Force Base San Antonio Tex.) developed a new type of prosthetic replacement for irreparably damaged joints of the finger (Fig 155) The prosthesis is a

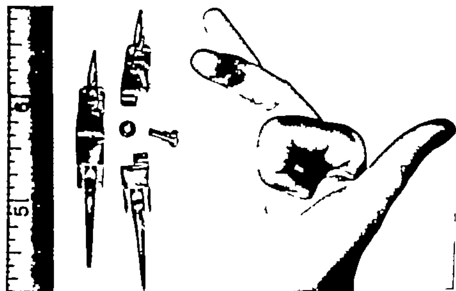


Fig 155 (left)—New type of prosthesis assembled and disassembled with component parts.
Fig 156 (right)—Postoperative result, showing degree of flexion.
(Courtesy of Brannon, E. W Mil. Med. 121 325-327 November 1957)

replica of the normal joint and replaces the entire joint Primarily designed for the proximal interphalangeal joint of the finger the device is of stainless steel and consists of two parts connected by a simple hinge joint that locks by a half threaded screw and nut. Each part has a triangular intramedullary stem for insertion into the bones of the finger The hinge joint is finely beveled to prevent irritation of the soft tissues during movement and the prosthesis is designed to preclude residual rotation of the finger and instability In dications for the procedure consist of an irreparably damaged middle or proximal finger joint with functionally restorable tendons intact nerve supply and adequate circulation in the finger The same type of replacement would ap-

(1) Mil Med. 121 325 327 November 1957

ply to a diseased joint, provided the condition of the soft tissues permits Any active inflammatory process would contraindicate this procedure

TECHNIC.—The operation is performed under general anesthesia and with pneumatic tourniquet A short midlateral incision is made on the ulnar aspect of the finger over the involved joint The extensor mechanism is carefully retracted and the joint capsule incised laterally Resection of the entire joint is performed with a small Gigli saw leaving a space of about 1 cm. between the bone ends The medullary canal of each phalanx is prepared with a triangular reamer after which each half of the prosthesis is inserted separately The two halves of the device are joined and the hinge joint is locked with the screw and nut After this the finger should be straight and there should be no abnormal rotation. The new joint should glide freely from full extension to full flexion. Hydrocortisone 1 cc., is left within the joint, after which the wound is closed. Finger is immobilized in full extension until wound heals then active exercises are started.

This method was used in 10 patients each of whom had destruction of the involved finger joint which had resulted in a stiff, useless finger usually ankylosed in extension In each prosthetic replacement of the joint (Fig 156) restored functional range of painless motion and the cosmetic appearance of the hand was improved by correcting the existing deformity

Acrosclerosis P Deak[2] (Teteny City Hosp Budapest) coined the term "acro-osteosclerosis" for an enostosis causing narrowing of the medulla of the terminal phalanx. It may appear in two forms patchy acro-osteosclerosis with islets of enostosis and the diffuse form in which enostosis affects the entire two thirds of the terminal phalanx. In the latter form a dense shadow is visible on x ray of which the proximal border is either sharp straight and perpendicular to the long axis of the bone or V shaped (Fig 157)

In a review of x rays of 400 unselected hands the author observed this disease quite frequently and with certain regularity Patchy acro-osteosclerosis was found in 17 patients and the diffuse form in 37 The over all incidence of 13 5% was too high to interpret the changes as concomitant signs of the relatively rare scleroderma

All diffuse forms of the disease and 14 of the 17 patchy changes were found in women Since 272 of the 400 hands belonged to women 1 of every 5 women showed acro-osteosclerosis

(2) Fortsch Geb Röntgenstrahlen 80 59-66 Jul 1958

The 4th and 5th fingers were involved three times as often as the others Without exception the changes were symmetrical and commonest in the area served by the ulnar artery When both forms of disease were present in the same hand, the patchy form affected the fingers closer to the radius and the diffuse form affected those closer to the ulna



Fig 157 (Courtesy f Dekk, P Fortschr Geb Röntgenstrahlen 80.59-66, July 1938)

Patients with diffuse acro-osteosclerosis had preceding hormonal dysfunctions such as irregular menstrual bleeding and severe preclimacteric symptoms for which some of them received prolonged intensive hormonal treatment. The diffuse form was also found to have an incidence of about 30% in hyperplasia glandularis cystica in which hyperfolliculinemia is very common

These observations would suggest that acro-osteosclerosis is due to a hormonal dysfunction which becomes mani

fest at certain sensitive circulatory sites such as the supply area of the ulnar artery and distal phalanges These findings are in agreement with the fact that long standing hormonal dysfunction and especially pathologic overproduction of folliculin is able to cause isolated medullary osteogenesis in man as well as in experimental animals

Epidermal Cyst in Bone is a rare lesion that occurs exclusively in distal phalanges of the fingers of adolescents or adults Edwin R Fisher John Gruhn and P Skerrett[3] (Pitts



Fig. 158.—Circumscribed, osteolytic lesion of terminal phalanx of 3d finger left hand in man, 48. (Courtesy of Fisher E. R., et al. Cancer 11 643-648, May June, 1958.)

burgh) report 3 cases of epidermal cyst in bone which brings the total recorded cases to 36 The patients 2 men and 1 woman were aged 32-48

Swelling redness pain and tenderness occurring 1 35 years after trauma and associated with a purely lytic circumscribed lesion surrounded by a thin rim of cortex is suggestive of epidermal cyst in bone Its morphologic features

(3) Cancer 11:643-648 May June 1958

are identical with those of the more commonplace epidermal cysts of the skin at other sites Diagnosis is seldom difficult though on occasion a prominent granulomatous reaction may superficially simulate a benign giant cell tumor of the bone particularly if only a few fragments are submitted for histologic examination Such lesions differ from other epidermal cysts only in that they cause osseous destruction a feature most likely due to the relative proximity

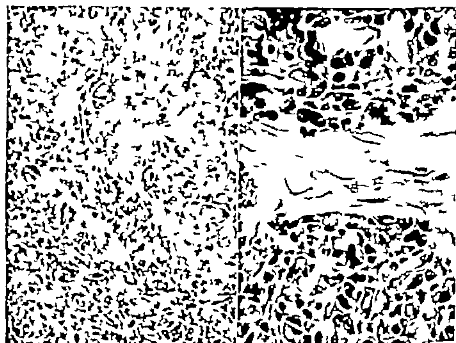


Fig 159 (left) —Low power appearance of granulomatous reaction observed in same patient, showing many multinucleated giant cells and histiocytes in fibrous stroma; reduced from ×175

Fig. 160 (right) —Higher magnification of lesion observed in same patient, revealing strands of keratin lying free as well as in cytoplasm of multinucleated giant cell reduced from ×410

(Courtesy of Fisher E. R., *et al* Cancer 11 643-648, May June, 1958)

of the skin to the terminal phalanges of the fingers This site is apparently subject to sufficient trauma to allow for implantation of epidermal fragments and subsequent cyst formation The problems involved are illustrated by the following case

Man, 48, was hospitalized because of remittent, sharp pain of 2 weeks duration in the tip of the 3d finger of the left hand. Examination revealed the soft tissues about the terminal phalanx to be swollen, tender and red. X ray study of the affected part revealed a circumscribed, lytic lesion of the distal phalanx, with a thin rim of cortical bone containing a fracture at one site (Fig 158)

Operation consisted of curettage. Sections stained with hematoxy

lin-eosin revealed irregular fragments comprised of viable bone interspersed among aggregates of multinucleated giant cells of the foreign body type lying in variable amounts of fibrous stroma (Fig 159) Strands and laminated masses of acidophilic acellular material morphologically identical with keratin were also observed at the periphery as well as within the cellular portions of the lesion The giant cells contained an average of eight round to oval nuclei dispersed at the periphery as well as throughout the entire cell in a few instances. Each nucleus possessed one or two distinct nucleoli. Mitoses or pleomorphism were not evident The cytoplasms of the giant cells were acidophilic, appearing more dense at their margins. Many contained optically clear vacuoles as well as strands of keratin (Fig 160) The stroma was comprised of plump fibrocytes and histiocytes collagen and small simple endothelial lined channels.

Identification of the acellular foreign material as soft keratin was confirmed by the fact that it was birefringent and faintly positive in sections stained by the performic acid Schiff and peracetic acid azure A technics.

Metastatic Tumors of Hand were studied by Robert Kerin[4] (Western Reserve Univ) in 5 males and 2 females One was aged 18 months and the others were between 47 and 70 A case is described

Man 58, fell on the left hand about 6 months before hospitalization. About 6 weeks later he noted swelling and pain in the hand just proximal to the thumb. He had no pulmonary complaints. Positive physical findings were confined to the left hand where the region of the 1st metacarpal was edematous and was the site of two open wounds draining purulent material (Fig 161) Histologic studies of curettage biopsy and drainage showed metastatic epidermoid carcinoma (Fig 162) Amputation below the elbow was performed. About 7 months later pulmonary complaints appeared and chest x ray study revealed a large infiltrative lesion in the right upper lobe.

The probable primary lesions were bronchogenic carcinoma in 2 patients adenocarcinoma of the kidney breast and rectum in 1 each neoplasm in the skin of the right foot in 1 and in the infant the primary tumor was sympathicoblastoma

The fact that the hand is generally not included in x ray examinations of the skeleton may account for the small number of metastatic lesions to the hand recorded in the literature.

Experience has indicated that metastatic malignancy is most often confused with felon or osteomyelitis Tuberculous dactylitis (spina ventosa) may also confuse the issue.

The problem of therapy is essentially the same as in other

(4) J Bone & Joint Surg. 40-A.263-278, April, 1958



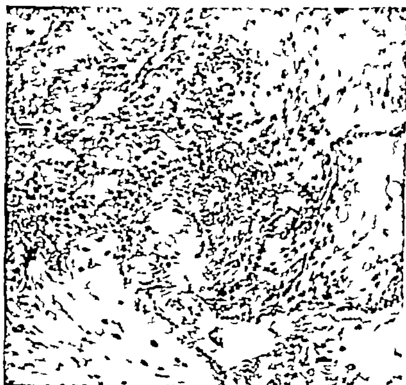


Fig 161 (top) —On admission, this swollen, painful, draining hand was misdiagnosed as tuberculosis. Loss of pigmentation is probably due to x ray therapy noted in history

Fig 162 (bottom) —Metastatic epidermoid carcinoma in 1st metacarpal, left hand, from bronchogenic carcinoma left lung

(Courtesy of Kerin, R. J Bone & Joint S rg. 40-A 263-278 April, 1958)

metastatic malignant growths Any measures that retard the primary neoplastic growth and the metastases are indicated For the most part therapy is arranged on a symptomatic and empirical basis

Surface Covering of Traumatic Lower Extremity Defects is described by William H Frackelton[5] (Milwaukee) Skin grafts are transplanted free of vascular or other tissue attachment A flap of skin fat is transplanted with a vascularized pedicle It survives on its own vascular supply while new and additional vascular channels proliferate from the edges and under the surface Flaps may be immediate or delayed

Local flaps may be preferable for ease of execution or may be used in conjunction with free grafts An advancement flap in its simplest form would be illustrated by direct closure obtained from undermined flaps of wound margins resulting from resection of a wide scar Rotational flaps are useful for coverage about the knee area and on the plantar surface for shifting durable tissue into the site of an excised ulcer They are especially beneficial for weight bearing areas of the sole A Z plasty is a special form of rotational flap useful for breaking up long linear scars and changing them to lie parallel to flexion areas of the popliteal space, thigh or hip

Free skin grafts alone may provide sufficient permanent coverage or may be used conjointly with pedicle flaps A medium thick graft is satisfactory for ordinary wear and tear of lower extremity use except for plantar surfaces Free grafts should be placed into their recipient areas only after all deep white scar has been excised and exact hemostasis obtained. A variation in use of free graft is the overgrafting procedure. Where skin grafts are applied and the areas remain unstable because of thinness of the graft a pedicle replacement might seem preferable In the aged or in patients with joints too stiff to favor positioning for a distant flap application overgrafting may be a reasonable substitute Distant flaps are frequently necessary for coverage of bones or tendons and must be applied before deep work, such as bone or tendon surgery is done.

Cross leg flaps are usually elevated and delayed in stages The most richly vascularized donor areas are the anterior

(5) S Clin. North America 38 1093-1106, August, 1958

thigh and medial calf Before initial operation the pattern of the flap and positioning during transfer are accurately determined The pattern is larger than the size of the contracted scar it is to replace If the flap is to cover an ulcer or



Fig 163—Posttraumatic ischemic scar defect of left leg and ankle with loss of lower portion of tibia due to injury in July 1951 at age 17 months In April 1953 a flap was outlined on abdomen, its upper half dissected free, and attached to forearm. After 3 weeks, lower half of abdominal flap was outlined, elevated and delayed except for 3 bridges A week later flap was cut free of abdominal attachment and with forearm as carrier was attached to leg. Raw abdominal area was covered with intermediate-thickness skin grafts. Two partial detachment operations were done 3 and 5 weeks later On June 19th, arm was completely detached from pedicle flap. Arm hinge was replaced with suture line closure and pedicle edge was set into leg Subsequently fibula was transferred to ankle, and epiphyseal control of opposite leg length is contemplated. Use of limb is satisfactory 7 years after injury (Courtesy of Frackleton W H S Clin. North America 38 1093-1106 August, 1958.)

bony cavity freedom from infection should be assured A draining osteomyelitis cavity is better covered first with a split thickness skin graft after bone debridement The graft, in turn is resected from the healed cavity at subsequent pedicle application

Contraindications to cross leg flap procedures are the existence of injury within potential donor areas of the opposite leg stiffness of hips or knees preventing required positioning and consideration of cosmetic defect in the donor thigh or calf of a female patient

Indirect flaps have an intermediary carrier between the donor area and ultimate recipient site such as the forearm carrying an abdominal flap to the leg (Fig 163) The flap may be tubed or nontubed Partial thickness skin grafts are most useful for covering acute traumatic defects of the lower extremity Local flaps are desirable replacements for avulsed or scar removal areas but are limited in size and transfer adaptability Flaps from a distance require extensive and often multiple operative stages but can salvage function of the leg

Unequal Leg Length in Children is discussed by Walter P Blount[6] (Marquette Univ) A short leg may be either functional as the result of angular deformity or structural from inequality of bone length Often the two types are combined It is particularly important to determine the part each plays in producing the appearance of shortness.

Purely functional inequality includes the short leg associated with the adduction flexion deformity of hip disease, the high hip associated with scoliosis a flexed knee from any cause the back knee or knock knee of poliomyelitis the bow leg and the flat foot. In the same way a long leg may be associated with a fused hip in abduction a stiff straight knee or a foot contracted in equinus These are all deformities or contractures that are amenable to orthopedic treatment. The legs are equalized by straightening them Structural shortening may be due to congenital anomaly or trauma. It may result from fracture of the bone shaft with overriding or trauma to the epiphysial plate. Retardation of growth of the epiphysis may occur after fracture into it from infection overexposure to x rays or operative insult to the germinal cells Structural excessive length may be the result of fracture of the bone shaft with acceleration of growth, particularly if there has been a refracture within a few weeks (Figs 164-166

Structural shortening can be overcome in a growing child by one or more of the following methods stimulation

(6) S Clin. North America 38 1107 1123 August 1958

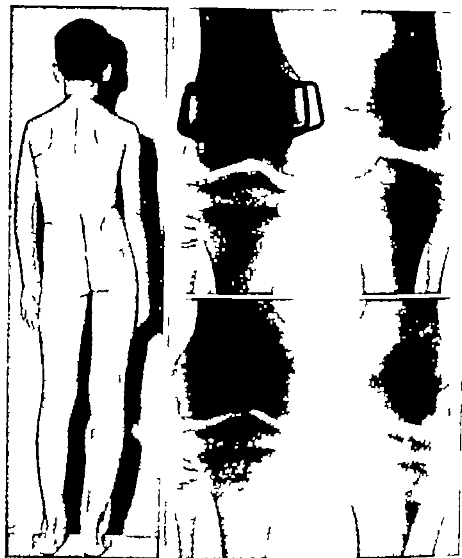


Fig 164 (left) —Boy 12 with fracture of right femur 4 years previously after open reduction, plating replating when first plate broke and removal of plate had 1 in. overgrowth of right femur

Fig 165 (top right) —Same case. Anteroposterior view of knees 16 months after right distal epiphysis was stapled. Epiphysial plate seems very thin whereas opposite one seems normally thick.

Fig 166 (bottom right) —Same view of knees 2 months after removal of staples from right distal femoral epiphysis. Epiphysial plate is now thicker than one on left. Distal end of right femur has characteristic shape of Florence flask as compared with left, which is shaped more like an Erlenmeyer flask, due to abortive attempt at tubulation despite stapling After this brief growth spurt of right femur both grew at same rate.

(Courtesy of Blount, W P S Clin. North America 38 1107 1123 August, 1958.)

of growth of the short bone retardation of growth of the long bone by stapling or epiphysiodesis leg shortening or lengthening or amputation and prosthetic replacement

Ideal in the equalization of a gross leg length discrepancy in a growing child is a long range plan with early stimulation of the short leg after age 8 epiphysial stapling of the distal femur and epiphysiodesis of the proximal tibia and fibula should be done The staples may be removed at just the right time to obtain the desired leg length

When correcting angular deformity and/or shortening due to epiphysial plate damage it is important to preserve growth potential and limb length even if several operations must be done Growth should be retarded only on the long side

► [The author of this article has been among the foremost in the effort to discover methods or technics for equalizing the leg length or correcting deformities due to unequal growth of the bones of children. This is a very concise statement in which the different procedures for equalizing leg length are evaluated and indications for each discussed.—Ed.]

Leg Lengthening Personal Follow up of 40 Patients Some 20 Years after Operation is reported by Harold A Sofield Sidney J Blair and Edward A Millar[7] (Shriners Hosp for Crippled Children Chicago) Most of the patients selected for leg lengthening were those with shortening of one extremity due to poliomyelitis In lengthening the tibia lengthening of the Achilles tendon was usually performed at start of the operation Then a segment of the lower portion of the shaft of the fibula was removed and the areas of Achilles tendon lengthening and fibula excision were closed

Double Steinmann pin fixation was done through both metaphyses A third incision was made along the entire shaft of the tibia the bone being bared by subperiosteal dissection The periosteum was not cut transversely A long Z type osteotomy in the coronal plane was made by drill holes and an osteotome After soft tissue closure, the leg was placed in the lengthening apparatus To allow for soft-tissue repair no attempt at lengthening was made for 3 days Tension was placed on the pins by daily tightening of a wing nut at the distal end of the apparatus Maximum lengthening was usually obtained within 3 weeks Sufficient union to allow application of a plaster cast usually occurred

( ) J Bone & Joint Surg 40 A 311 322, April, 1958.

in 6-8 weeks Maximum lengthening obtained was 3¼ in., not without considerable discomfort to the patient. Unsupported weight bearing was usually possible after 4 months.

No nonunion and no long delayed union occurred. Moderate angulation developed in several patients but was cor



Fig. 167—Patient had poliomyelitis of right lower extremity at age 2. At age 10 preoperative discrepancy was 2½ in. (A); tibia was lengthened 2¼ in. At age 33 discrepancy was ¼ in. and gait was fair (B). Total evaluation improved. (Courtesy of Sofield, H. A. *et al* J Bone & Joint Surg 40-A 311-322, April, 1958.)

rected without undue difficulty Transitory neurologic changes were experienced by 5 patients and permanent loss occurred in 2 Vascular complications were rare and of no permanent importance

Practically all were pleased and enthusiastic about the results (Figs 167 and 168) The appearance of the limbs and the fairly horizontal positioning of the pelvis were cosmetically satisfactory and an improvement over preoperative conditions When the patients were standing the body was erect and well balanced

In 35 of the 40 patients the lengthened limb continued its lengthened measurement into adult life Since these limbs were steadily becoming relatively shorter before surgery the maintenance of leg length actually represented continued growth stimulation that did not cease in 1 3 years after the bone was well healed and the circulation apparently

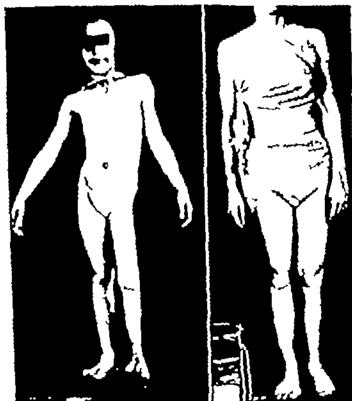


Fig 168 —Patient had poliomyelitis of left lower extremity at age 18 months. At age 9, discrepancy was 1½ in. (*left*) Preoperative discrepancy at age 12 (not illustrated) was 3 in Tibia was lengthened 2½ in. At age 32, overgrowth of lengthened leg was ¼ in (*right*) Total evaluation improved. (Courtesy of Sofield, H A *et al.* J Bone & Joint Surg. 40-A 311-322 April, 1958.)

became restored to its preoperative condition It is evident that the stimulation for increased longitudinal growth induced by the trauma of surgery exerted its influence throughout the remaining growing years

Practically all patients in whom the tibia had been lengthened had foot deformities of some degree One constant complication even with lengthening of the Achilles tendon, was increasing talipes equinus deformity Despite lengthening tenotomy and use of foot supports on the lengthening frame this deformity became established and was aggravated as leg lengthening increased

The principal fault of leg lengthening was that muscle evaluations in the adult were decidedly weaker when compared with those made preoperatively Hip muscles that before surgery were rated good became only fair after leg lengthening and muscles that were fair before surgery dropped to poor after leg lengthening The hip muscles particularly the abductors showed the greatest loss of power and loss was more evident in tibial than in femoral lengthening Decreased muscle power was noted in the years immediately after operation but it was presumed that with the passage of years preoperative muscle power would return. This hope was not realized in the statistics If any change occurred it was toward further weakening of the affected muscle groups Even patients who had excellent musculature of the extremity before lengthening showed appreciable loss of muscle power after lengthening and such loss was not regained

If a patient is too old for satisfactory reduction in leg length inequality by means of epiphysiodesis and if over all stature is so short that reduction in height by leg shortening is undesirable leg lengthening might be considered Situations in which parents refuse to permit surgery on the good leg may call for lengthening When leg lengthening is contemplated certain criteria must be met adequate muscle power should be present about the hip and thigh to control the lengthened unit shortening of at least 1½ in must be present to justify such formidable procedure maximum gain of not over 3 in should be attempted and good bone and joint structures should be present. In old osteomyelitis and old joint disease lengthening is contraindicated

Simultaneous Occurrence of Coxa Plana in Enzygotic Twins. In coxa plana the aseptic necrotic and necrobiotic changes in the caput are due to ischemia of unknown cause. In the boys observed by Lennart Soderberg[8] (Malmo Sweden) the disease started at about the same time and both showed similar x ray changes They lived under conditions as identical as possible They had not had any diseases of infancy or any known trauma Thus no environmental factors were known that might have caused the disease The family history revealed no other cases of hip disease. The boys parents were studied by x rays and neither showed signs of

(8) Act orthop scandinav 27 135 140 1957

a pathologic condition The disease in these 2 patients may have been congenital

Pathogenesis of Degenerative Arthrosis of Hip Joint Its Bearing on Surgical Management Thomas Horwitz[9] (Indianapolis) states that various unrelated and often dissimilar lesions involving the femoral head and/or the acetabulum eventuate in secondary *deformity Any process—developmental* disease or traumatic—that alters the anatomic components of the hip disorders the relation of the femoral head and acetabulum or changes the dynamics of the hip may encourage the appearance of this secondary lesion Specifically a broadened flattened and hypertrophied femoral head may follow such primary lesions as displacement of the capital femoral epiphysis congenital or acquired coxa vara osteochondral fracture partial or total dislocation of the femoral head and aseptic necrosis arising from a wide variety of causes. Less often the primary lesion may affect the acetabulum and involve the femoral head secondarily A developmentally defective acetabulum without any involvement of the femoral head initially may serve also as the basis for secondary degenerative changes in the hip Primary degenerative arthrosis of the hip occurs without any specific pre-existing lesion of the joint and may be interpreted as a disease *sui generis* In the advanced stages of primary and secondary degenerative arthrosis the clinical x ray and pathologic changes become indistinguishable

In the primary type the femoral head enlarges protruding beyond the confines of the acetabulum and it appears flattened as the result of a combination of loss of articular cartilage over the proximal and weight bearing portion encircling bone deposition at the head neck juncture, especially medially and posteriorly and widening of the femoral neck by periosteal deposition (Fig 169) Foreshortening of the femoral neck is only apparent being due to hypertrophy of the femoral head broadening of the femoral neck and relative overgrowth of the great trochanter Actual retardation of neck growth may be seen in the secondary type after early closure of the capital epiphysial plate

Lateral subluxation of the femoral head may occur the interval between the medial surface and the acetabulum becoming filled in by the medial beak of the enlarged femoral

(9) B U. Hosp. Joint Dis. 18 33-44 April, 1957

head and by a reduplication of the acetabular floor Further displacement of the head may follow more bony deposition incidental to the flexion adduction external rotation deformity which develops frequently (Fig 169) This sequence of

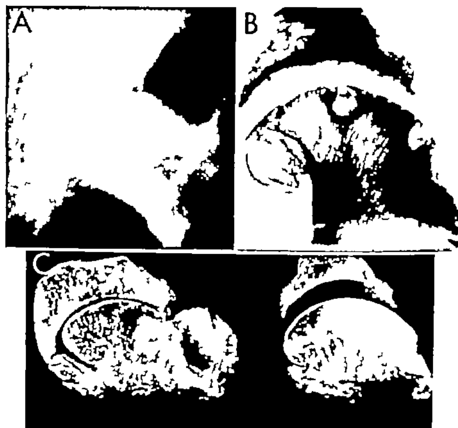


Fig. 169 —Right hip of woman age 60 *A* advanced degenerative arthrosis with flattened, enlarged femoral head within sloping defective acetabulum that is densely sclerotic superiorly *B* film of section of femoral head removed at autopsy shows that portion of apparently flattened femoral head is actually large medial exostosis, details of which are lost in *A* and that cartilage persists only over this exostosis and adjacent medial portion of femoral head. Note also cyst formation in pressure area of femoral head. *C*, autopsy specimen. (Courtesy of Horwitz, T Bull. Hosp Joint Dis. 18 33-44 April, 1957)

pathologic changes is seen also in secondary degenerative arthrosis though modified by the preceding traumatic or disease process or anatomic deformation of the hip

Changes in the acetabulum occur early in response to deformity of the femoral head the outline of the acetabular joint surface conforming with great accuracy to the altered outline of the head of the femur The sloping acetabular roof formed by a combination of resorption superiorly and osteophytosis laterally becomes indistinguishable in its more ad

vanced stages from cases in which degenerative arthrosis has arisen on the basis of primary acetabular dysplasia

In a large series the author found no instance of aseptic necrosis as part of the pathologic picture in degenerative arthrosis However an advanced expression of the second ary type of degenerative arthrosis will evolve after poorly or incompletely treated aseptic necrosis of the femoral head a lesion that may arise from various causes

► [Osteoarthrosis of the hip occurs most often as a result of a defective articulation due to deformity of a femoral head from Legg Perthes dis ease or preadolescent slipping of the capital femoral epiphysis Congenital dysplasia of the hip, if not corrected will almost certainly result in osteo-arthritis before age 40 Prevention of osteoarthrosis should be a primary consideration of every surgeon who treats orthopedic conditions in chil dren. *No effort to prevent or correct the faulty articulation of the hip of* a growing child would be too great.—Ed.]

Surgery of Osteoarthritic Hip Philip Wiles[1] (Middlesex Hosp Med. School) reviews the literature and describes his technic of arthrodesis The *object of surgery is not to cure* but to relieve symptoms Since deformity and stiffness un accompanied by pain rarely require surgery pain is virtually the only indication Since no operation gives a perfect re- sult it is essential to be certain that the condition in terms of both pain and function is so severe that it may be expected to improve after surgery X ray appearance gives no indica- tion of pain or extent of *interference with function*

COMPARISON OF OPERATIONS FOR OSTEOARTHRITIS OF HIP

	MOULD ARTHROPLASTY	OSTEOTOMY	ARTHRODESIS
Pain	Relieved in [illegible] reduced in [illegible]	Relieved in [illegible] reduced in [illegible]	Relieved in all
Deformity	Usually corrected	Often corrected	Usually corrected
Stiffness	Reduced in most	Unchanged in most	Increased in all
Function, Walking	{Good in [illegible] Fair in [illegible]	Improved in the [illegible] with reduced pain	Usually good
Static	{Good in [illegible] Fair in [illegible]		Much impaired
Durability	Uncertain, say 5–10 yr	Apparently permanent	Permanent
Strain on spine	Unchanged or reduced	Unchanged	Increased

(1) Brit. J Surg 45 488-497 March, 1958.

The three surgical procedures used are arthroplasty displacement osteotomy and arthrodesis The advantages and disadvantages of these methods are shown in the table. In children and adults under 40 arthrodesis gives the best results

The author uses arthrodesis to promote fusion by close apposition of large areas of cancellous bone second to incorporate a graft, including cortical bone which quickly thickens to give strength, and third to prevent movement by internal fixation while fusion takes place (Fig 170)

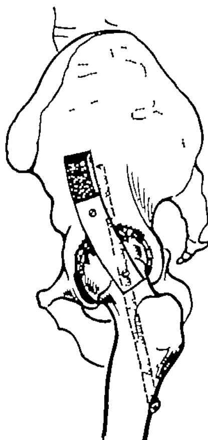


Fig 170 —Wiles arthrodesis. (Courtesy of Wiles, P Brit. J Surg. 45 488-497 March, 1958.)

TECHNIC.—The articular cartilage and cortical bone are removed from the head of the femur and acetabulum preferably after dislocating the hip but, if necessary without dislocation. A graft is cut from the outer table of the concavity of the ilium where the curve allows it to be moved downward to overlap the neck of the femur This increases the area of cancellous bone in apposition and provides cortical

bone. Internal fixation is done with a Watson Jones trifin nail driven through the neck of the femur into the ilium The nail prevents abduction and adduction until union has occurred, but does not protect against flexion because the outer cortical surface of the shaft of the femur is splintered when the nail is introduced The almost hollow neck gives no support with only the cancellous and, possibly cystic head to prevent the femur rotating around the long axis of the nail In most patients, therefore a short plaster spica is applied for additional security The spica need not, as a rule, extend below the knee and hence does not cause stiffness of the knee joint Also, it does not prevent the patient from being lifted into a chair soon after operation or from walking in a few weeks.

► [This is a carefully documented presentation filled with common sense advice on the best way to treat the osteoarthritic hip. I definitely agree with the conclusion that "in children and young adults with a normal spine, say in those under 40 years, arthrodesis gives the best results." Arthrodesis is the only method of treatment which consistently results in a stable, painless hip. Many patients however will not agree to arthrodesis Mold arthroplasty as described and carried out by Smith Petersen, has produced many excellent results. A posterior lateral approach leaves better muscular control of the hip. Many of the devices recommended and used during the past 15 years to replace a destroyed or necrotic femoral head by some type of plastic or metal prosthesis have been poorly designed and impractical. The more complicated the device and the more separate parts which must be fitted together the more likely the complete failure of the attempt at rehabilitation.—Ed.]

Skin Arthroplasty of Hip Joint and Corresponding Alloplastic Methods in Light of Clinical Study Erkki Kallio[2] (Univ of Helsinki) reviews results of 35 Vitallium cup 83 endoprosthesis and 53 skin arthroplasties performed on 163 patients aged 12 77 The technic of the last type is described

TECHNIC.—The patient lies on his side, with the lower limbs hanging down to make the trochanteric region prominent. The skin of the lower part of the abdomen is left uncovered (Fig 171) The operation under general anesthesia, is done by a posterolateral approach on the lateral aspect of the trochanter through the skin and fascia lata. The trochanter is temporarily detached. The head of the femur is dislocated and the capsule resected. Osteophytes on the head and neck of the femur are removed but the shape of the articular surface of the head with the arthrotic, smooth, sclerotic weight-bearing area is left intact, to allow it to retain its natural form. The acetabulum if intact, is not touched. Thus the joint surfaces of the head and the acetabulum fit each other in the natural way The surface of the head however is freshened with a file.

The interposition material is obtained from the skin of the abdomen. A circle about 8-9 cm. in diameter is drawn, and a steel wire is passed through the skin around the circle (Fig 171) At 0.5-1 cm. outside the circumference a circular incision is made, and the piece of whole skin with an appropriate layer of subcutaneous fatty tissue is detached. The margins of the skin defect are temporarily pressed

(2) Acta orthop. scandinav., supp. 30 1958.

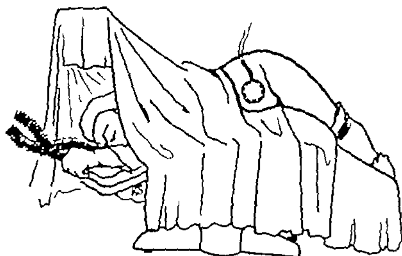


Fig 1 1 (Courtesy f Kallio F Acta orthop. scandinav., supp 30, 1958.)

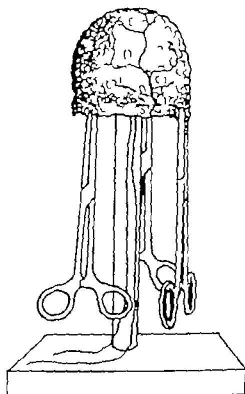


Fig 172 (Courtesy of Kallio, E. Acta orthop. scandinav., supp 30 1958)

together by pincers. The skin graft is stretched and shaped into a cap on a "hatblock" on which it has been placed with the subcutaneous fatty tissue upward (Fig 172) A trial reposition is now done. After this the skin cap is placed on the head of the femur and tightly attached to it by the steel wire which was threaded through the circumference of the skin flap The edges of the skin flap are sutured around the capsule with catgut The femur is now reduced and the trochanter fixed with a couple of steel wires and the incision closed

The incidence of complications during a follow up period of 1 7 years was lowest (11 3%) in the skin arthroplasty group No infections occurred in this group Absence of the preoperative pain or definite relief was reported by 62% of patients in the skin arthroplasty group and by 65% in the Vitallium cup and 87% in the endoprosthesis groups

► [While the roentgen picture of end results in most of the cases after skin arthroplasty does not appear to be noteworthy the clinical or functional end results in the majority of instances have been good. Most American orthopedic surgeons, however prefer to use a pre prepared lining for the joint, such as a Vitallium cup or a prosthesis Time and future reviews of patients treated by various technics should eventually give the correct answer to this controversial and perplexing problem.—Ed.]

Evaluation of New Hip Prosthesis Used in 60 Patients and 62 Hips over 6 Year Period is presented by Eugene L Jewett and F DeWitt Stanford[3] (Jewett-Wright Orthopaedic Clinic Orlando Fla) The Jewett prosthesis was used in 15 patients who had relatively fresh femoral neck fractures in 30 who had old fractures with nonunion and/or aseptic necrosis of the femoral head (Figs 173 and 174), in 12 who had abnormal relationship between the femoral head and the acetabulum and in 3 who had osteoarthritis of the hip joint.

Results in the 15 patients with fresh neck fractures were satisfactory in 9 good in 3 and unsatisfactory in 3 Results in the 30 with old fractures were successful in 9 unsatisfactory in 6 though all had much less pain than they had preoperatively and good in 15 Results in the 12 who had abnormal relationship between the femoral head and the acetabulum were satisfactory in 5 good in 3 and unsatisfactory in 4 though 3 of these had less pain than before operation Results in the 3 with osteoarthritis of the hip joints were satisfactory in 1 and unsatisfactory in 2 Of the 60 patients 43 were followed for an average of 27 months Among the 43 results were excellent in 53% good in 12% and unsatisfactory in 35%

(3) Am. Surgeon 24 213-222, March, 1958.

The authors are working on a combination prosthesis that is to be composed of an endoprosthetic stem or distal part and a proximal component similar to the one used in most of the study patients. A hip prosthesis appliance should be so constructed that as much of the length of the femoral neck as possible is re-established and to this end collars must be used. In certain instances in which the hip-nail appliance is in place the aim should be to remove the necrotic



Fig. 173.—Woman, 71, fractured right femoral neck in May, 1949. On Nov. 6, 1952, necrotic head was removed and Jewett prosthesis put in. Patient now walking with one crutch, no cane. Follow-up 12 months. (Courtesy of Jewett, E. L., and Stanford, F. D.: Am. Surgeon 24:213-222, March, 1958.)

head and involved neck of the femur and then place the prosthesis with or without the collar over the nail which remains in situ. The patients will be the aged debilitated group in whom motion, partial weight bearing and relief from pain will be the main objects to be attained. Hip-nail appliances with angles of 135-155 degrees will be preferable for this purpose. Femoral flanges or plates should have at least six screws in them and the prosthetic stem should come fairly close after settling has taken place, to the outer cortex of the femur and the angle of the nail and its flange. In many of these hips bone chips from the ilium

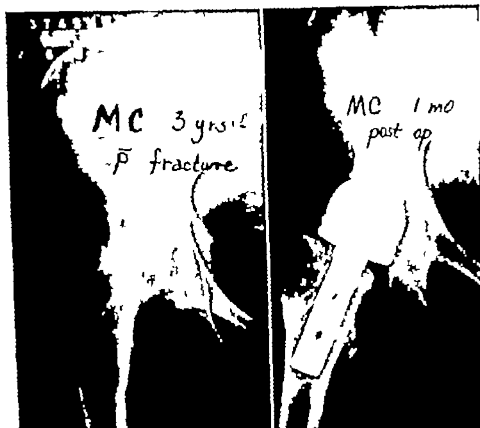


Fig 174—Woman, 61 fractured right femoral neck in September 1954 This was originally nailed with Smith-Petersen nail which was later removed. Aseptic necrosis of femoral head developed and on Mar 12 1957 femoral head was removed and new Jewett prosthesis put in. (Courtesy of Jewett, E. L., and Stanford, F D: Am. Surgeon 24 213-222, March, 1958)

should be packed down around the Smith Petersen nail part of the appliance and the stem of the prosthesis This will protect the nail and its flange extension from undue stress in weight bearing (partial) or adductor muscle pull

Resection Angulation of Femur for Redemption of Hip Joint can be used, according to Henry Milch[4] even after failure of a prosthetic operation and offers the hope of painless stable hip mobility in all conditions of hip disease It has been used specifically in treatment of tuberculosis of the hip atrophic and hypertrophic arthritis ununited fractures of the femoral neck and congenital dislocations of the femoral head

The femoral head is not the only site of disease in arthritis of the hip The capsule is thickened and often adherent

(4) Bull. Hosp Joint Dis 18 45-50, April, 1957

to the femoral neck. The femoral head is irregular and the normal hyaline cartilage is irregularly absent. The acetabulum is surrounded by marginal osteoarthritic outgrowth and its cartilage too is eroded. To think that cure would result from placing an artificial femoral head into an acetabular cavity which is markedly damaged by osteoarthritis is wishful thinking. This is confirmed by the fact that in fractures of the femoral neck prosthetic replacement of the head has resulted in about 40% cures, whereas in arthritis only about 20% cures have been reported 1 year after operation. However, in 64 operations performed on 56 patients resection angulation resulted in almost complete relief from pain in over 67%, with marked improvement in 25% more. Motion was restored in 53% of the whole group and improved in another 29%. The series included bilateral as well as unilateral cases of varied etiology. In unilateral cases results were somewhat better than those obtained in the whole group. Pain was relieved entirely or improved in over 95% of the patients, and motion was improved or rendered satisfactory in over 85%.

Because of the two separate phases which characterize the resection angulation operation, its use is indicated in conditions in which there is limitation of motion or painful motion resulting from inflammatory conditions within the joint. It is therefore indicated in treatment of various specific and nonspecific infections of the hip. It is also suggested for all conditions in which instability of the hip exists or is feared. Thus it should be used in fractures of the femoral neck where nonunion has occurred and in congenital dislocations of the head where shallowness of the acetabulum precludes firm stabilization of the femoral head. Resection of the femoral head and neck re-establishes the possibility of mobility without pain. Angulation osteotomy restores stability.

Though arthrodesis may be the most expeditious treatment for the unilateral case, it cannot be advocated for bilateral hip involvement. In the latter, the minimum acceptable result is at least one hip which is painless, movable and stable. Therefore the resection angulation operation should be attempted preferably on the side of greater pain. If the outcome is satisfactory, a similar procedure can be

undertaken on the opposite side Bilateral operations have been performed as closely as 6 weeks apart but it is probably wiser to defer the second operation until there has been a fairly satisfactory adjustment to the first. Resection of the femoral head and neck disturbs the entire kinesiologic pattern of the hip The pelvitrochanteric muscle becomes relatively too long and must undergo gradual contracture before readjustment can be considered complete. This may take as long as 6 months and it appears wiser to await the end of readjustment on one side before submitting the second side to the same difficulties

Indications for Arthrodesis of Hip in the Adult are discussed by M Guilleminet and J Desbrosses[5] on the basis of 90 cases Arthrodesis usually presents little difficulty in the young patient but may do so in arthritic or obese persons aged 50-60 Gravity of the procedure is reflected in the relatively high mortality (6 deaths) among the patients reported Thromboembolic complications are frequent (about 7% in this series with 1 death) Despite the risks, arthrodesis should not be rejected when there are definite indications for it. Improved technics may even extend its benefits safely to persons over age 60 the present accepted limit

Results of arthrodesis are determined by quality and position of ankylosis which should allow about 10-15 degrees of abduction 20 degrees of flexion (to facilitate sitting) and rotation of the leg with the foot in normal position Mobility and strength of the knee and condition of lumbosacral and sacroiliac vertebrae also influence results

Major indications for arthrodesis of the hip include coxarthrosis coxalgia and congenital luxation Lesser considerations are paralysis tabetic arthropathy and pseudarthrosis of the femoral neck. Failures of arthroplasties with ineffective interposition materials are grouped with coxarthrosis

In coxarthrosis pain is a primary indication for surgery Unilateral coxarthrosis may be due to a luxation reduced in childhood (8 cases) dystrophy (5) subluxation (2) an old injury (10) acute arthritis in childhood (4) or the result of primary arthrosis (10) Of 39 arthrodeses for coxarthrosis only 2 were not intra articular Articular surfaces were always cut and the cotyloid cavity revitalized by removal of osteophytes and other capsuloligamentous debris In 33 in

(5) Lyon chir 54 161 182 March, 1958.

Fig. 175.—Arthrodesis with tibial graft replacing unsuccessful acrylic prosthesis. It fits into old prosthetic canal, penetrating pelvis across cotyloid cavity. Intrapelvic end is fused, complete regeneration of graft results in satisfactory ankylosis. (Courtesy of Guilleminet, M and Desbrosses, J : Lyon chir 54 161 182, March 1958.)

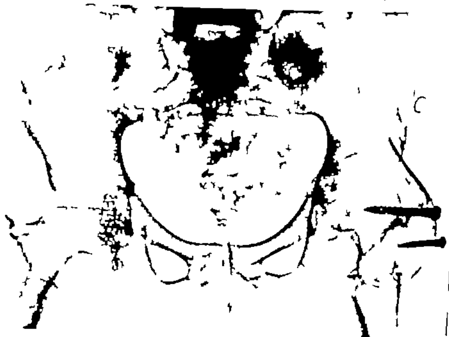


Fig 176.—Left hip [illegible]formity [illegible]f several years standing originally considered as osteochondritis dissecans, confirmed on synovial membrane biopsy as due to coxalgic geodes. Afte[illegible] [illegible]ra-articular arthrodesis with an iliac graft as well intertrochanteric osteot[illegible] [illegible] correction, fusion was complete. (Courtesy of Guilleminet M and Des[illegible] [illegible] J Lyon chi[illegible] 54 161 182, March, 1958.)

stances operation was implemented with a graft (heterogenous in 8 cases) When the two hips are affected equally arthrodesis should not be considered but it can be of benefit when lesions are dissimilar, according to the classic rule of mobility on one side solidity on the other

Failures of arthroplasty due to ineffectiveness of replacement prostheses present a special problem Failures resulting from unsuccessful use of a Vitallium cup (2 cases) are simple to treat, because the femoral neck and head remain those involving an acrylic prosthesis (14 cases) are difficult as the stump which remains is insufficient for easy arthrodesis In such cases use of an autogenous or even heterogenous graft is necessary to replace bone loss and secure good consolidation (Fig 175) With the abandonment of earlier enthusiasm for acrylic arthroplasty arthrodesis has been more widely used as primary therapy and as a salvage procedure after failure of a mobilizing operation

In tuberculous coxalgia arthrodesis is indicated only after a long afebrile period with return of normal sedimentation rate and general improvement. Signs of local inflammation should delay operation (Fig 176) In 7 patients an old caseous pouch was found which did not presage favorable results Arthrodesis is indicated for the adolescent in whom destructive lesions offer no hope of satisfactory orthopedic cure (9 patients) and especially for the adult (10) who has had frequent bacillary exacerbations from infancy There is no set rule for timing operation but it should be done in a remission period usually after 12 18 months medical treatment sometimes less if infection is in the early stage Choice of technic also must be individualized The authors prefer to stay away from the disease focus not because of risk of dissemination but because of poor quality of bone which may under consolidation Among 31 cases of coxalgia a para or juxta articular technic was used in 24 and an ischiofemoral method in 4 (Fig 177) Intra articular technic was used in 3 patients with recurrent coxalgia Results were excellent in 26 Of the other 5 1 was lost to follow up 2 have incomplete ankyloses which however permit almost normal activity and 2 died from postoperative complications

Among 16 patients with intractable congenital luxation arthrodesis was primary treatment in 7 and it was used as treatment for recurrence after earlier orthopedic measures in

2 and after original surgical intervention in 7 Luxation subjected to arthrodesis is usually the anterior type with or without arthrosis Experience shows that arthrodesis gives the most satisfactory results whereas the easier arthroplasty and osteotomy have been disappointing Arthrodesis for luxation in the adult is most difficult In 3 instances a second



Fig 177—Coxalgia in i fancy destroyed femoral head and caused adduction with pelvic tilting Hip fter ischiofemoral arthrodesis with correction of adduction by osteotomy and restoration of pelvic balance. (Courtesy of Guilleminet M and Desbrosses J Lyon chir 54:161 162, March 1958.)

procedure was necessary for effective ankylosis Results in 10 of the 16 patients were excellent 3 had pain or other symptoms and 3 cases were too recent to evaluate results

Arthrodesis of Hip Review of Series of More Than 500 Cases Max Lange[6] (Munich) lists three technics he uses for arthrodesis of the hip joint.

1 Combined arthrodesis with a plain Smith Petersen nail and a bone graft blocking through a slot at the external side of the femoral head and the acetabulum This method was used most and gave the best results It is indicated for patients in good general condition with noticeable mobility of the hip joint

2. Arthrodesis with a Smith Petersen nail with inner

(6) J Internat Coll Surgeons 29 638-643 May 1958.

blocking A hole is drilled parallel to the Smith Petersen nail and soft bone is inserted through the drill hole by a ram ' into the region of the articular interspace. This operation is advocated for patients with minimal hip joint mobility

3 Double nailing This procedure is most suitable for elderly patients The end results may be influenced by migration of one or both nails This may be avoided by inserting a splint into the shaft of the femur through a hole at the free end of the nail The nail then fits tightly and displacement toward the outside is impossible No plaster fixation is necessary and the patient may get up within 2 weeks

These technics were used in 500 patients In 85% good clinical results were achieved

Recurrent Dislocation of Patella in the Adult End Results of Patellectomy with Quadricepsplasty were studied in 20 patients by Francis E West and Ralph Soto Hall[7] (San Francisco) Recurrent dislocation of the patella in the adult generally presents severe degenerative changes in the articular cartilage of the patella and not infrequently presents so-called mirror image changes in the lateral condyle of the femur and chondromalacia After dislocation of the patella was corrected by capsuloplasty, fascial transplants transplantations of the patellar tendon or osteotomy a high percentage of late poor results was encountered because mechanical arthritis of the patellofemoral joint developed after a number of years These changes came from chondromalacia and distortion of the patella after being restored to the intercondylar groove friction of the incongruous surfaces produced irritation

Patellectomy without quadricepsplasty is an illogical procedure because abnormal mechanics persist and recurrent dislocation of the tendon may result The authors do not know the exact age at which irreparable changes may develop in the patella or how long subluxation must be present before chondromalacia develops

Of the 20 patients all but 1 showed advanced degenerative changes of the articular cartilage. Recurrent dislocation of the patella results from congenital developmental or traumatic factors or from a combination of these. In an effort to correct the anatomic deformities and at the same time

(7) J Bone & Joint Surg 40-A 386-394 April, 1958.

to eliminate the hazards of patellofemoral arthritis a new operative procedure was devised by the authors which was used on the 20 patients in 24 operations

TECHNIC.—The operation is performed in a bloodless field obtained with use of a tourniquet The patella is approached by cup-shaped incision the center of which passes just below the patella. The quadriceps expansion is incised in the same manner so the incision passes over the level of the inferior third of the knee cap This tends to bring the suture line of the tendon into the area of the fat pad rather than into the line of the femoral condyles The quadriceps tendon is carefully removed from the patella by meticulous sharp dissection.

The joint is carefully inspected. Loose bodies are removed and if the femoral condyle presents an area of polished surface or chondromalacia the area of diseased cartilage is beveled by sharp dissection Small drill holes are placed where subchondral bone is exposed so that fibrocartilage may form. The capsule is then drawn distally to overlap about ½ in. to restore proper tendon tension It should be displaced medially ½ ¾ in The height of the patella should be studied in preoperative x rays to determine the correct distance of distal overlapping The shifting of the quadriceps medially leaves a gap in the capsule laterally which should be left unsutured. The synovial membrane should be closed if it can be easily approximated. The vastus medialis muscle which has been sectioned at its insertion and forms a V-shaped mass is then transferred distally and laterally This results in partial covering of the defect by the muscle at the previous site of the patella If reattached in this manner contraction of the vastus medialis will tend to bring the capsule medially After repair the knee should be tested so that flexion to 90 degrees without undue tension of the sutures can occur Absorbable interrupted sutures are used and the subcutaneous tissue and skin are closed in the usual manner after removal of the tourniquet.

During follow up of 1½ 12 years no recurrence or deterioration of the quadricepsplasty was observed

Joint Changes Following Experimental Partial and Total Patellectomy in dogs were studied by Anthony F DePalma and Joseph J Flynn[8] (Philadelphia) Excision of part or all of the patella resulted in progressive abnormalities consistent with advanced hypertrophic arthritis The alterations were least in magnitude when the superior or inferior half of the patella was spared Although knee joints examined 40 days after surgery showed slight increase in the gradient of involvement severe alterations were not encountered until about , months had elapsed (Fig 178) When these alterations ere severe pain and dysfunction re ulted The regions of e joint most severely affected were those comprising the patellofemoral joint

(8) J Bone & Joint Surg 40 A 395-413 April, 1958

It is assumed that the changes result from abnormal fri-
tion of soft tissues against cartilage and bone and impairme
of the mechanism whereby the articular cartilage on t
anterior surface of the femur is adequately nourished Simil
alterations in configuration of the knee joints of other an
mals including man, may be followed by similar change



Fig 178.—Total excision of patella (117 days) In left joint, patellar bed is smooth and glistening and no changes are demonstrable in femoral side of joint. In right joint, no changes are discernible. (Courtesy of DePalma, A. F., and Flynn, J J J Bone & Joint Surg 40-A 395-413 April, 1958.)

The differences in anatomic construction of the knee joint of the dog and that of man preclude accurate assessment of the severity of such alterations.

Other factors may play a role in production of the alterations Although culture of material from all joints was done at the time of sacrifice, still possibility of infection cannot be completely ruled out. Repeated aspiration of the joint might throw more light on this aspect of the problem

It is suggested that when possible the patella or at least its superior or inferior pole should be preserved and that in instances when deletion appears mandatory new methods should be designed whereby the normal mechanics of the joint are restored

Extensibility of Gastrocnemius Muscle at Rest and during Contraction J D Thomson[9] (State Univ of Iowa) found that the medial head of the rat gastrocnemius shows greater static and semidynamic passive tension (per square centimeter of cross section area) than the lateral head. When the two resistances are regarded as being in parallel the resistance of the lateral and medial heads together (1 16 and 4.71 mm /second 1 5 mm stretch) approximates the resistance of the whole muscle. Resting muscle shows a slow rise and low tension at 0.29 mm /second a rapid rise and higher tension at 1 16 mm /second and declining tension rise and level with faster stretches The lateral head yields more readily than the medial head The former controls the reaction of the whole muscle to stretch at rest Tetanized (15 c.) muscle shows a linear faster tension rise with faster stretches Excess (over isometric) tension related to resting stretch tension shows a decline with stretch (yielding) The amount of excess tension increases with the speed of stretch The lateral head shows less excess tension rise than the medial head The medial head controls the reaction of the whole muscle to stretch during isometric tetanus

The author attempted to explain why the lateral head appears to control the behavior of the whole muscle at rest, whereas the medial head appears to control the response of the whole muscle to stretch during contraction He lists the following possible causes (1) The lateral head is significantly heavier than the medial head. Perhaps the heavier head exercises more control over whole muscle response at rest than does the lighter head. (2) The bipennate fiber arrangement of the lateral head might be responsible for its controlling influence i e. the response of a double row of fibers (lateral head) may be more like the response of a triple row (medial and lateral heads) than is the response of a single row (medial head) (2) During tetanus of 15 c the lateral head fibers may be more responsive to oscillations than those of the medial head i e the former may be more thixotropic than the latter and so show a more marked departure from its controlling function. It is of interest in this connection to note that extratension curves of the lateral head fibers at all speeds of stretch rise more slowly than curves for those of the medial head and tension attained at 5 and 8 mm stretch and

(9) Am. J Ph vol. 191 193 199 October 1957

calf and which initiate proprioceptive impulses Elimination of these impulses breaks the vicious cycle of the stretch reflex. The easiest operative technic, after isolation of the sural nerve is to approach either side of the muscle belly and to dissect from above downward to the attachment between the gastrocnemius and soleus After the tendon is severed the gastrocnemius is isolated inside the deep fascia by passing the finger up to the knee to break all the fibrous bands passing to the soleus and to free the muscle from the sides of the fascia so that the finger can be passed entirely around the muscle. If the foot is then dorsiflexed there may be other bands including the plantaris longus muscle which must be cut to remove all connections between the gastrocnemius and soleus and fascia of the calf After operation a toe to groin cast is applied and is replaced in 4 weeks by an ankle-to-groin cast. This is replaced as often as necessary until the knees remain straight without any flexion

The operation was performed on patients who had not walked before (group 1) and also on those who had walked at least in some fashion (group 2) Of 16 patients in group 1 results were excellent in 12 fair in 1 and poor in 3 Of 7 patients in group 2 results were good in 4 fair in 1 and poor in 2

The procedure is chiefly indicated for a child under age 6 who has bilateral cerebral spastic palsy and has never walked Operation under these circumstances could be a worthwhile first step in treatment when the following findings are present (1) extensor spasm of the hips knees and ankles with relative rigidity of the back which develops when the child is suspended with the examiner s hands beneath the axillae and (2) no gastrocnemius spasm when the foot is dorsiflexed above 90 degrees

The procedure is not indicated for patients with athetosis

Double-Contrast Arthrography of Knee Joint is done by A Ruttimann[4] (Univ of Zurich) by the following technic.

TECHNIC.—For the double-contrast method of joint visualization a negative contrast medium, air, and a positive medium a contrast solution, are used. Before the joint is tapped, it should be relaxed by exercise. It is then punctured under aseptic conditions and local anesthesia. The needle should be about 4-5 cm. long about 1 mm wide and have a short bevel. Joint effusions when present should be removed. Depending on the size of the joint, about 40-100 cc. of air is

(4) Fortschr Geb. Röntgenstrahlen 87 736-756, December 1957

for rupture In younger patients the cause may be a direct cutting injury violent contraction of the quadriceps muscle in an attempt to break a fall or violent leverage from acute flexion of the knee by a force applied at the foot or toes

The cardinal symptom of rupture is inability of voluntary extension of the knee. An associated symptom is loss of complete control of the leg on attempting to ascend or descend stairs Stationary standing is possible but active locomotion is impossible if the tear is complete. After the original knife-like cutting pain discomfort is minimal A profuse hemarthrosis is noted with a prominent bulge where the hematoma becomes subcutaneous through the area of the disrupted tendon The anterior aspect of the femoral condyles and supracondylar area can readily be felt, because only skin and some subcutaneous fat separate the examining fingers from the bone. Because of loss of the quadriceps muscle tonicity the patella lies at a slightly lower level than normal.

Diagnosis should not be difficult but is often missed. It may be delayed until the swelling has gone down the quadriceps tendon has been drawn proximally and the patella is lying loose in the anterior compartment of the knee. By that time fibrosis and contracture of the quadriceps may make successful management difficult or impossible. Complete tear of the tendon requires surgical correction preferably within the first 48-72 hours after injury

Except for surgical infection results in these cases are good to excellent. Younger patients make a more rapid and complete recovery than older persons. Patients skilfully operated on with anatomic reapposition fascial reinforcement and approximation maintained with Bunnell pull-out wires do better than those with reapposition of the torn tendon with catgut alone. After surgery a cylindric cast is applied from groin to ankle with the knee in complete extension It is removed in 6 weeks with the Bunnell pull-out sutures. Active use of the leg is recommended and physical therapy instituted. Crutches are required for 2-4 weeks

Gastrocnemius Recession Five-Year Report of Cases is given by Luther M Strayer Jr[3] (Bridgeport, Conn) Recession of the gastrocnemius used in treatment of cerebral spastic palsy is designed to remove the stimuli which originate in the isometric biarticular antigravity muscles of the

(3) J Bone & Joint Surg. 40-A 1019-1030 October 1958.

are characterized by a trough shape and by sharp margins

A tear in the meniscus is demonstrated as an air filled slit within the soft tissue shadow of the meniscus framed by a fine margin of positive contrast. Great variation in the extent shape, course and localization of meniscus tears can be seen from minute tears to subtotal destruction (Fig 180)

Degenerative changes of the meniscus are usually within microscopic limits. Only extensive degeneration can occasionally be demonstrated by arthrography

Tomoarthrography of Meniscal Lesions of Knee Joint 15 Verified Cases. P Klami and M Kurkipaa[5] (Central Hosp Jyvaskyla Finland) report a method for examining the menisci of the knee joint by tomoarthrography

TECHNIC.—A Siemens horizontal planigraph with rectilinear movements is used. It is equipped with a clamp fork shaped at each end, by means of which the patient s pelvis is secured to the table. This clamp which can be positioned by manually operated screws in grooves on either side of the table, is drilled with holes 5 cm. apart into which pegs padded with latex foam rubber can be inserted. For the frontal view the extremity to be examined lies along the median line of the table with one peg between the thighs and a second peg in such relation to the pelvis that when the patient is turned on his side for the lateral view this peg remains below the anterior superior iliac spine, whereas the first peg supports the pelvis close to the tuber ischii. To stretch the extremity longitudinally the shaft and shoe of a plaster table are fixed with a manually operated screw to an upright metal rod mounted at the end of the examination table. The height of the shaft can thus be regulated. A few small pieces of foam rubber are placed under the patient s pelvis. To insure adequate accumulation of the opaque medium on the surfaces of the meniscus, the joint being examined is placed under slight traction in longitudinal direction. Simultaneously the joint space is opened by stretching the knee medially or laterally depending on whether the medial or lateral meniscus is to be examined.

To prevent the proximal part of the joint cavity from filling with contrast medium, a small piece of foam rubber is placed transversely proximal to the patella and tied with an elastic bandage. The bandage is wound from the back of the knee joint obliquely to the distal part of the joint, around the upper portion of the leg again behind the knee joint so it crosses the previous turn, then back to the proximal part of the joint. Slight traction is applied to the extremity and the joint cavity is filled with 50% water soluble contrast medium. Despite this high concentration, it has not proved necessary to anesthetize the joint cavity The volume injected is about 15 ml., of which some 10 ml. is withdrawn. The puncture wound is sealed aseptically traction is released and for 1 minute, if the lesion permits,

(5) Acta radiol. 48:248-256, October 1957

injected into the joint space, using a 20-cc. syringe. This is followed by injection of a combination of 20 cc. air and 3-4 cc. contrast material The syringe and needle are removed, and slight compression applied to the injection area will close the injection canal and prevent escape of injected air As a contrast medium, a 50% solution of Joduron Triopac Triurol or Urografin may be used.

Spot films are taken after each meniscus has been positioned separately under fluoroscopic control Films of the meniscus with a sus-



Fig. 179 (top) —Medial meniscus, posterior horn. Anatomic recess on superior and inferior aspects of capsular attachment shown by arrows.

Fig 180 (bottom) —Subtotal destruction of the meniscus. Arrows indicate horizontal and vertical tears.

(Courtesy of Rüttimann, A. Fortschr Geb. Röntgenstrahlen 87 736-756, December 1957)

pected lesion are taken in 8-10 different positions to visualize its entire circumference. Large, medium and occasionally even small tears in the meniscus are easily seen on fluoroscopy

The oblique ligaments may be visualized by a mediolateral beam shooting through the knee, which is in 45 degree flexion.

The normal meniscus visualized by an orthograde beam appears on the fluoroscopic screen as a wedge-shaped soft tissue shadow the apex of which points to the interior of the joints It is surrounded by air in the free joint space. At the base of the wedge near the capsular attachment recesses may be present on the superior or inferior aspect or on both (Fig 179) The recesses are normal variants and

is obtained. Tomograms at 0.5 cm. distances between layers are now taken first from the side clinically suspected, then from the opposite side after the direction of the side traction has been changed. The exposure factors are 60 kv 160 ma., focus film distance 140 cm Potter Bucky diagram Sinegran Sapir screens.

Traction in the longitudinal direction is released but not removed and the patient is placed on the side of the extremity under investigation. The other extremity is flexed against the trunk and supported with cushions. Traction is again applied. When the medial meniscus is being investigated, the medial part of the joint may be opened out by elevating the cushions supporting the extremity (Fig 181) When the lateral meniscus is to be examined (Fig 182) sandbags are placed on the extremity at sufficient distance from the joint. Oblique projections, if necessary may also be obtained After the examination the extremity is placed on a splint for 1 or 2 days.

In evaluating the tomograms it is advisable to reconstruct their relative positions in relation to the knee joint with the aid of the scale diagram.

This method was applied to 15 patients and good agreement between tomoarthrographic results and operative findings was obtained in all

Meniscus Tears Diagnosis and Treatment are discussed by George Chapchal[6] (Univ of Utrecht) A clinical diagnosis can be made if some of the following signs are present. Payr's sign consists in pain at the medial aspect of the knee in the tailor s position It points toward damage of the medial part of the meniscus and is accompanied by local tenderness and pain in maximum flexion and extension of the knee. Steinmann s sign is dorsal shift of the meniscus and tenderness with increasing flexion In Böhler s sign pain is elicited on the side of the damaged meniscus by abduction and adduction According to Konjetzny Steinmann, rotation of the tibia with the knee flexed produces pain. If pain occurs on outer rotation it indicates a tear of the tibial portion of the meniscus if it occurs on inward rotation it implies a tear of the fibular meniscus. Bragard s sign should help establish diagnosis by the tenderness of the damaged meniscus palpation of a loose articular body and auscultatory determination of snapping of torn torn-off or folded meniscus parts Bloody or serous articular hydrops also occurs and locking or restricted motility of the knee. In Kroemer s sign pain and locking of the meniscus are caused by alternate flexion and extension of the knee. McMurray s sign is associated especially with a tear of the posterior horn

(6) J Internat. Coll. Surgeons 28 647-653, November 1957

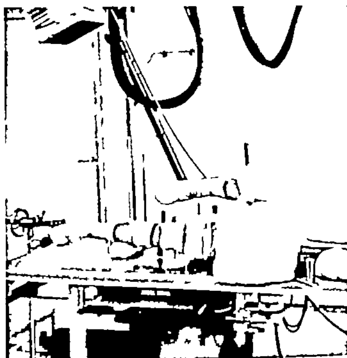


Fig 181—Positioning of patient for lateral tomoarthrography of medial meniscus, with cushion under leg (Courtesy of Klami, P and Kurkipää, M. Acta radiol. 48 248-256 October 195)

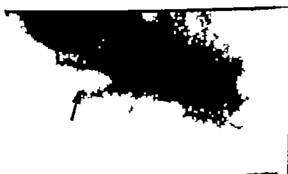


Fig 182—Lateral meniscus, lateral view Relatively broad fissure in inferior surface of anterior wedge. (Courtesy of Klami P and Kurkipää, M. Acta radiol. 48 248-256 October 1957)

extreme flexion and rotation movements of the knee joint are performed

With the patient supine, the extremity is again placed under as much traction as can be borne without pain. An elastic tape is fastened somewhat distally to the knee joint and the extremity is drawn sideways toward the meniscus to be examined the knee joint being supported by padded cushions placed under the calf and thigh. A scale rule of lead calibrated in centimeters is placed vertically near the joint space and an ordinary lateral view scale diagram of the joint

nective tissue formation in hyperextended and torn tissue. Hyperextension occurs during marked flexion with tibial endorotation and lacks the typical characteristics of a trauma. A tear in the meniscus does not therefore result from a flexion or extension rotation trauma or from a rotatory strain but from a rapid extension started from a flexed position with exo- or endorotation without previous opportunity to neutralize such rotation. This is generally a sequel to fixation of the foot due to incarceration (spiked shoes, skis or rising from a crouching or sitting position in a limited space).

In most instances of cyst formation trauma of the meniscus is involved, i.e. the condition results from an acute or fast-acting external traumatic force. The cause is often an accident or an often repeated abnormal motor mechanism necessitated by the patient's occupation. Actually, however, injuries of the meniscus arise only as a result of an unco-ordinated movement in a weight bearing knee.

Although cyst formation is often associated with transverse tearing of the lateral meniscus, the pathogenesis of the two conditions is completely different. The latter occurs during extension with impaired rotation and is more or less in the nature of a trauma; the former occurs during flexion with tibial endorotation and is nontraumatic. Injuries of the meniscus occur as a result of the traumatic force itself; the cysts are reactive products in tissues which attempt to restore themselves after hyperextension and small tears associated with normal and well-co-ordinated movements. The same holds true for the cysts so frequently observed in discoid menisci. These menisci too are hyperextended, being voluminous and slow and therefore unable to cope with rapid movements and varying stresses.

Osgood-Schlatter Lesion: Radiologic and Histologic Study. B. Cohen and R. W. Wilkinson[8] (Postgrad. Med. School, London) review 11 cases of Osgood-Schlatter disease, in 7 of which histologic examination was possible. An attempt was made to establish etiology by study of case histories and of radiologic and histologic evidence. Radiologic examination affords observation of the sequence of events in the diseased tubercle, helps to exclude infective and neoplastic processes with their characteristic sequelae and allows comparison with the tubercle of the unaffected knee. Histo-

(8) Am. J. Surg. 95: 31-42, Ma 1958

and requires simultaneous outer rotation and abduction of the lower leg If the leg is extended in this position a clear snapping can be heard

When the clinical signs appear doubtful the menisci should be examined by x ray Exploratory arthrotomy should be avoided whenever possible Arthrographic studies furnish detailed information about degenerative processes and the direction of clefts in the posterior horn of the meniscus They show that the posterior horn is more frequently the site of pathologic changes than has hitherto been assumed Arthrograms also reveal that tears in the lateral meniscus are not rare.

The injured part of the meniscus should be removed in time to avoid damage to the articular inner cavity Diagnosis of the tear and the indication for arthrotomy should be determined early preferably soon after the injury but after subsidence of the acute symptoms For this purpose arthrographic study is indispensable as the definite clinical symptoms appear only later or in the presence of advanced changes Resection is the treatment of choice

Technic.—With the patient under general anesthesia and in ischemia a small incision is made to avoid a needless scar in the capsule which could later restrict motion and the interior of the joint cavity is inspected Then the torn-off part of the meniscus is seized with a clamp especially constructed for this purpose and removed from the marginal (undamaged) part of the meniscus. Care is taken to prevent further damage to the meniscus and to insure that the cruciate ligaments or articular cartilages are not injured If the meniscus is extensively destroyed the anterior horn is seized after it has been separated from its insertion and the meniscus is circumcised at the base which is left intact. This procedure is highly important, for the base of the meniscus may serve as a foundation for regeneration which later takes over the function of the cartilage For repair of an injury of the posterior horn of the meniscus a posterior incision is used

After operation a pressure bandage is applied and ischemia discontinued. For 4 days the patient is kept at complete bed rest with the leg almost fully extended. On the 5th day massage of the quadriceps muscle and active patellar play are started This therapy is constantly intensified until on the 7th day careful passive exercises are permitted and on the 10th day the patient is allowed out of bed

Pathogenesis of So-called Cystic Degeneration of Lateral Meniscus is discussed by G den Otter[7] (Haarlem The Netherlands) Cysts of the meniscus should not be regarded as products of degeneration but as results of irregular con

(7) Arch. [illegible] 84 390 1957

bercle from preceding disease Disruption to normal appositional relationships between tendon cartilage and bone supports the concept of a damaged complex subjected to excessive force The fact that a traumatic cause was mentioned in only 1 case history is not considered important since minor injuries during adolescence often pass unnoticed

Similarly the radiologic features found provided no evidence of infection or new growth but suggested that the Osgood Schlatter lesion essentially results from dislocation of appositional structures within the tibial tubercle complex that dislocation is followed by repair reactions and that the origin of the lesion can most feasibly be ascribed to trauma.

► [The conclusion of Cohen and Wilkinson that the origin of Osgood Schlatter disease "can most feasibly be ascribed to trauma" oversimplifies the question of etiology There must be a pre-existing condition which would explain the occurrence of the lesion, certainly when it is bilateral in patients of sedentary habits who could recall no stress on the tendon attachments or trauma to the tibial tubercle—Ed.]

Late Results of Transplantation of Tibial Tubercle in Recurrent Dislocation of Patella are discussed by Torsten Jerre and Bertil Knutsson[9] (Halsingborg Sweden) For some 20 years all patients at the authors clinic with recurrent dislocation of the patella who underwent surgery were treated by transplantation of the tibial tubercle.

TECHNIC.—A lateral lambdoid incision is made over the knee and extended a short distance proximal to the base of the patella and a few centimeters distal to the tibial tubercle. The ligamentum patellae is dissected then the tibial tubercle is chiseled off The ligamentous capsule of the knee on the outer side is slit longitudinally up to the level of the base of the patella. A thin bone flap is then chiseled up medially below the original site of the tibial tuberosity and the tibial tuberosity is fixed under this bone flap usually with a Rissler pin and a few catgut sutures about 1 cm. medial and 1 cm distal to its original site. After suture of the subcutaneous tissue and skin the knee flexed at about 10 degrees is fixed in plaster which is removed at 6 weeks, after which active and passive movements are begun.

This technic was used in 28 patients aged 15-45 In all the dislocation was outward There were no primary surgical complications of importance

After a follow up of 1 1 19.7 years 18 patients were asymptomatic 9 occasionally had a feeling of tiredness slight aching and/or mild pain and 4 had had recurrences in the form of dislocations or subluxations However x rays revealed arthrosis deformans in most of the patients

► [The technic described of transplantation of the tibial tubercle in re

(9) Acta orthop scandina 27 141 152, 1957

logic study contributes to an understanding of etiology in two ways. First, the presence of old degenerative change would provide evidence of primary disease following which traumatic effects might be a secondary event. Second the presence of uncomplicated reparative changes in altered re-



Fig. 183.—Insertion of tendon into extensive bone fragment, vulsed from main body of tibial tubercle, reduced from ×35. (Courtesy of Cohen, B. and Wilkinson, R. W.: Am. J. Surg. 95: 731-742, May 1958.)

gions would afford evidence of normal reaction to acute damage.

Positive evidence of altered architecture within the tibial tubercle complex could be adduced from most specimens studied (Fig. 183) together with positive signs of reparative changes. No degenerative processes were found. Thus histologic features support the belief that trauma is a primary etiologic factor and negate the hypothesis of a weakened tu-

the Y should meet ¼ in. proximal to the metatarsophalangeal joint. If the arms of the Y extend too far proximally, insufficient tissue is left to obtain secure medial capsulorrhaphy The neck and shaft of the metatarsal are stripped subperiosteally (Fig 184) The lateral capsular attachments are not disturbed because these structures are the only remaining source of blood supply to the metatarsal head. The exostosis is removed flush with the shaft of the metatarsal. Two holes are drilled one being ½ in. and the other 1 in. from the articular surface The distal drill hole is slightly medial so that the holes will be in line when lateral shift of the head is accomplished Care is taken to place these holes perpendicular to the metatarsal shaft. A no

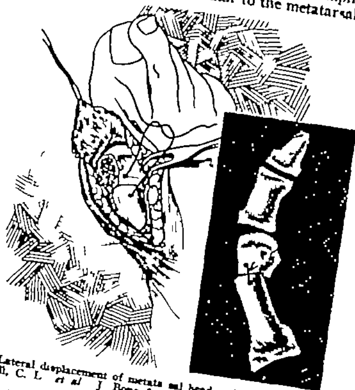


Fig 185 —Lateral displacement of metatarsal head and suture stabilization. (Courtesy of Mitchell, C. L *et al* J Bone & Joint Surg 40-A 41-60 January 1958.)

1 chromic catgut suture is placed through the holes with ligature carrier or straight needle.

A double incomplete osteotomy is done ¼ in. from the articular surface between the drill holes and perpendicular to the shaft. The thickness of bone between the two cuts depends on the amount of shortening of the metatarsal that will be necessary to relax the contracted lateral structures. Usually about 2 3 mm of bone is removed. The size of the lateral spur depends on the amount of metatarsus primus varus to be neutralized by lateral shift of the metatarsal head. In a moderate deformity one sixth of the width of the shaft is left to form the lateral spur whereas in severe deformity one third of the shaft remains. The osteotomy is completed proximally with a thin saw blade Then the metatarsal head is shifted laterally until the lateral spur locks over the proximal shaft (Fig 185) The head is

current dislocation of the patella yields excellent clinical results, if it is used only in adolescent or adult patients. Transplantation in childhood would result in epiphysial growth disturbances and deformity of the knee. *Undoubtedly the authors were aware of this For surgeons who may not* be so well informed of the danger of producing knee deformities if this procedure is carried out during the earlier growth years, a strong statement of warning is needed.—Ed.]

Osteotomy Bunionectomy for Hallux Valgus C Leslie Mitchell, Joseph L. Fleming Richard Allen Christopher Glenney and Glenn A Sanford[1] (Henry Ford Hosp) review

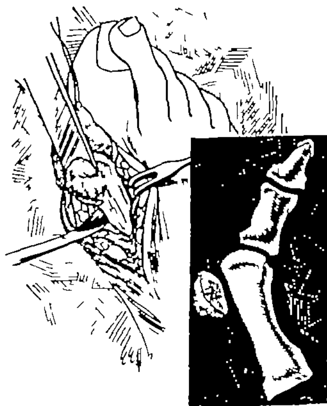


Fig 184 —Removal f exostosis. (Courtesy f Mitchell, C. L et al. J Bone & Joint Surg 40-A 41-60 January 1958)

over 400 operations done for hallux valgus with metatarsus primus varus in which a distal 1st metatarsal osteotomy with lateral displacement and angulation of the head was used. This operation was not done in simple hallux valgus without metatarsus primus varus

TECHNIC.—A dorsal medial incision is made on the foot curving above the bursa and callus A Y shaped incision is made through the medial capsule and the periosteum of the 1st metatarsal The arms of

(1) J Bone & Joint S g 40-A 41-60 January 1958.

► [The technic described here is approximately the one that I first learned and used when I served for a short time as an assistant resident to Dr Charles Peabody then Chief of Orthopaedic Surgery at Henry Ford Hospital. The excellence of the end results in the large series of cases studied by Mitchell *et al* constitutes strong argument in favor of this procedure. The fact that prolonged splinting is required, while the realined osteotomized 1st metatarsal is uniting does constitute one objection to the operation. For the patient concerned more with the final satisfactory end result who is willing to endure many weeks of immobilization and subsequent convalescence this is an operation that must be considered when planning surgical correction of hallux valgus—Ed.]

Plantar Interdigital Neuroma according to Thomas L Duncan and John L. Wright[2] (Ochsner Clinic) is a tumorous enlargement of the plantar digital nerve usually at the

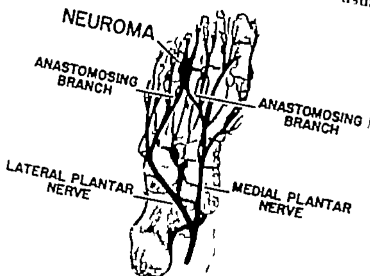


Fig 187—Usual location of plantar interdigital neuroma. (Courtesy of Duncan T L. and Wright, J L. South. M J 51 49 51 January 1958.)

3d metatarsal interspace (Fig 187) The nerve to this space is more vulnerable to trauma because of its more limited mobility Repeated minor trauma from ill fitted footwear is undoubtedly the cause The fourfold predominance in women is thought to be due to their greater use of tightly fitting high heeled shoes which shift most of the body weight to the metatarsal heads Whether trauma to the nerve is due to compression by the metatarsal heads pressure of the nerve against the transverse metatarsal ligament, traction on the nerve fibers or a combination of these is unsettled.

Histologically the neuroma is an acellular connective tis

(2) South. M J 51 49-51 January 1958

angulated slightly laterally so that its articular surface parallels the axis of the 2d metatarsal Slight plantar displacement or angulation is desirable at this stage. The suture is tied, giving surprising stability to the osteotomy site

Medial capsulorrhaphy is carried out with the hallux held in slight overcorrection. Chromic 00 is commonly used for the capsular repair The toe is then released and examined. It should stay in complete

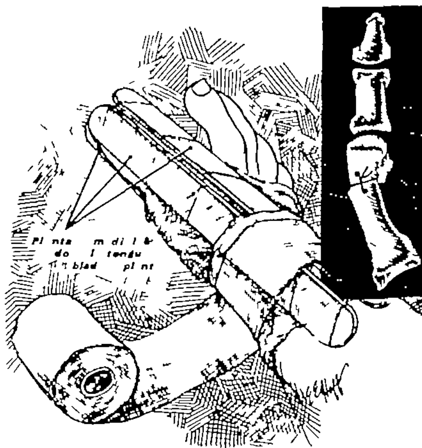


Fig. 186.—Application of dressing made from tongue depressors. (Courtesy of Mitchell, C. L., et al J Bone & Joint Surg 40-A:41-60 January 1958.)

correction as a result of the capsulorrhaphy If it does not, the distal capsular flap should be shifted farther proximally and resutured. Post operative splinting will not provide correction that is not obtained at operation Splints made of padded tongue depressors are applied with the toe in slight overcorrection and in 5 degrees of plantar flexion, to avoid dorsal displacement or angulation at the osteotomy site (Fig 186) The splint is worn for 10 days. After suture removal a short walking cast is applied to the leg incorporating the great toe.

Follow up on 59 patients who had 100 operations showed generally satisfactory results in 82% of the operations

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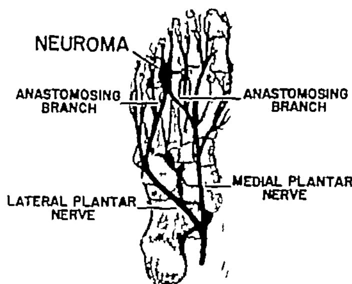


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(2) South. M J 51 49-51 January 1958.

sue proliferation with few nerve fibers compared to a true neuroma The nerve bundles are separated by collagenized tissue representing perineurium There is no inflammatory reaction It has been termed a sclerosing neuroma. Grossly the neuroma is smooth and oblong usually 1 1 5 cm long and 0 4-0.7 cm in diameter it has a fatty surface and the cut surface is firm white and fibrous

The characteristic complaint is that while walking the patient feels a sudden sharp burning pain or severe cramping and numbness in the 3d and 4th toes The pain extends into the ball of the foot and is often so severe that the patient will remove the shoe and massage the foot In a few moments there is relief associated with a sense of click or snap about the forefoot The attacks increase gradually in severity and frequency in severe cases they occur when the patient stands Symptoms last a few months to several years.

Conservative treatment consists in reducing trauma to the neuroma by use of Oxford shoes with moderate heels strong shanks and a metatarsal arch pad inside the shoe a metatarsal bar on the sole or in some cases both Operative treatment consists in excision of the neuroma.

► [The interdigital neuroma is a neuroangioma, which is probably caused by repeated minimal trauma. T G Morton, who first accurately described the clinical manifestations of this condition in 1876 and subsequent writers erroneously thought it to be merely a neuritis of the 4th digital nerve. Robert T McElvenny, in 1943 demonstrated the true nature of the condition and described the interdigital neuroma and the only effective treatment for this condition, which is surgical excision.—Ed.]

Shortening of Metatarsal Shaft in Treatment of Plantar Keratosis End Result Study is reported by Nicholas J Giannestras[3] (Good Samaritan Hosp Cincinnati) Plantar keratosis is a reaction of the soft tissue to overlying and underlying abnormal pressures caused by improperly fitted shoes If the pressure is relieved the lesion disappears spontaneously Therefore conservative therapy for at least 6 months should be attempted. The regimen consists in wearing a comma shaped metatarsal pad in a properly fitted shoe. In addition the patient is advised to trim the keratosis at least once weekly If complete relief does not result from this treatment surgery is recommended.

METHOD —Anteroposterior x rays are taken with the patient standing A small lead marker is taped directly on the plantar keratosis to determine its exact location in relation to the overlying metatarsal

(3) J Bone & Joint Surg 40-A 61 71 January 1958.

head. If the lesion is not directly under the metatarsal head or the metatarsophalangeal joint this surgical procedure will not succeed. The operation shortens the metatarsal shaft at the base. Because the texture of the bone at this level is more cancellous, callus formation and healing will occur more rapidly. The procedure is carried out *under tourniquet ischemia.* The incision is made on the dorsum of the foot over the metatarsal above the keratosis beginning at the tarsometatarsal joint and extending distally about 2½ in. After the extensor tendons are retracted the small muscles originating in the metatarsal shaft are gently reflected subperiosteally. Bunion retractors

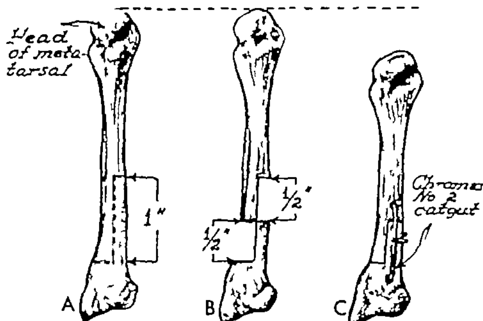


Fig 188.—Steps in operative procedure *A* drill holes outline step cut *B* osteotomy completed and portion of each tongue of step cut resected and *C* shortened metatarsal. (Courtesy of Giannestras, N J J Bone & Joint Surg 40-A 61 71 January 1958.)

are then placed on either side of the metatarsal shaft to retract the small muscles and to expose the proximal two thirds of the shaft. With a bit 1/16 in. in diameter inserted in a small pistol-grip hand drill, a series of holes is made and a 1 in step cut is outlined (Fig 188, *A*) A thin osteotome ⅛ in wide is used to complete the step cut. With a sharp double action rongeur ⅛ in. of each tongue of the step cut is resected, thus shortening the metatarsal (*B*) With the same drill a hole is made through the dorsal cortex of the distal and of the proximal fragment of the metatarsal in a slightly oblique fashion with the obliquity toward the open end of each fragment to permit passing the needle and the suture more easily. A double no 2 chromic catgut suture is passed through the 2 drill holes, pulling the 2 bone ends together (*C*) The metatarsal should be shortened at least ⅛ in. If it is difficult to pull the 2 bone ends together because of tissue fibrosis a Kocher forceps can be applied around the distal fragment and

the shaft gently pushed proximally while the suture is pulled together and tied Skin closure is not difficult because only the keratosis is excised.

After the incision is closed, a snug fitting padded plaster cast is applied with the metatarsophalangeal joints held in moderate plantar flexion. The cast is fitted snugly so that the head of the osteotomized metatarsal will be in a slightly dorsal position. A walking heel is applied and the patient is ambulatory with or without crutches, on



Fig. 189 (left).—Infected plantar keratosis under 2d metatarsal in patient with mild diabetes.

Fig. 190 (right).—Same foot 3 months after surgery Result was still excellent when patient was last seen

(Courtesy of Giannestras, N J: J Bone & Joint Surg 40-A 61 71 January 1958.)

the 5th postoperative day The cast is removed at the end of 4 weeks. A comma shaped metatarsal pad, ⅛ in. thick, is worn in the shoe for 6 months

The author performed 40 such procedures with excellent results (Figs 189 and 190) in 82 5% and good results in 10% Failures (7 5%) were mainly due to errors in technic and judgment.

► [Excision of a keratosis or trophic ulcer and the underlying prominence on the metatarsal head has in many instances, proved to be sufficient for cure of this condition The operation described by Giannestras is practical but requires a long time to obtain an end result.—Ed.]

AMPUTATIONS AND PROSTHESES

Amputation Stump Pain, according to Thomas J Canty and Eugene E Bleck[4] (US Naval Hosp Oakland Calif) is the commonest complaint of the amputee seeking medical care. Review of the medical histories of over 7 000 amputees treated during the past 12 years revealed that all at one

(4) U S Armed Forces M J 9 635-647 May 1958

time or another have some pain but pain is not persistent in all Congenital amputees usually have little or no pain Patients with gangrene due to thromboangiitis obliterans may have severe pain that even massive doses of narcotics fail to relieve. After amputation these patients seem to have more than usual immediate and late postoperative pain Neoplasm requiring amputation may or may not be painful If the neoplasm becomes large severe pain often ensues

Immediately after operation most amputees have severe pain from surgical trauma It is important to realize that postoperative pain after amputation is greater than that after usual surgical procedures The pain is more severe because amputation cuts across skin subcutaneous tissue, fascia muscle periosteum bone blood vessels and nerves Postoperative edema is always present causing pressure pain

After a stump heals most amputees may be subjected to stump pain at intervals for the rest of their lives Over 50% have stump pain or discomfort sufficient to discontinue temporarily the use of their prosthesis About 15% have major pain problems that are caused by improper fit and/or alinement of the artificial limb dermatologic conditions of the stump bursitis or osteomyelitis in the stump trauma, chronic anoxia of the terminal end of the stump osteoma and/or spurs neuromas or phantom limb

Proper treatment of amputation stump pain is to remove the cause of irritation in the stump

Improved Prosthesis for Hemipelvectomy was developed by Shyh Jong Yue and Charles R Goldstine[5] (Columbia Univ) The early prosthesis consisted of a large leather bucket to support the lower abdominal tissue (Fig 191) A wide abdominal belt was used to fasten the bucket and a shoulder strap was installed in some for added support The difficulty with this prosthesis was excessive telescoping of the soft tissue into the bucket, in some instances allowing excursion of 4 in or more. Due to lack of support excessive pressure was exerted in the groin and perineum

To combat the disadvantages of the early leather prostheses plastic molded buckets (Fig 192) were made to fit the stump which consists essentially of soft tissue In addition a bridge extending from the lower part of the bucket across the midline to engage the remaining ischial

(5) Arch. Phys. Med. 38 781 784 December 1957



Fig 191.—Front and back views of hemipelvectomy prosthesis with large leather bucket and abdominal belt. (Courtesy of Yue, S. J., and Goldstine, C. R.: Arch. Phys. Med. 38:781-784, December, 1957.)

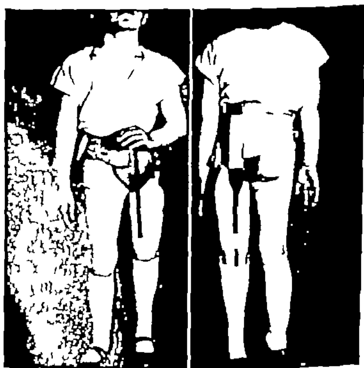


Fig 192.—Hemipelvectomy prosthesis with molded plastic bucket and bridge extending to other side. (Courtesy of Yue, S. J., and Goldstine, C. R.: Arch. Phys. Med. 38:781-784, December, 1957.)

tuberosity or heavy muscle groups took over a portion of the weight bearing The bucket extended above the costal margin and a wide pelvic belt was well fitted over the crest of the remaining ilium Repeated adjustment was often necessary to relieve pressure of the bucket on the ribs and remaining sacrum A regular prosthesis was attached to the bucket by a regular hip joint. Roller castings were added to the upper portion of the thigh piece to give more stability to the hip attachment In patients wearing this type of prosthesis, the sense of balance and gait pattern were considerably improved Telescopic movements were largely eliminated

Some problems of comfort and utility still remain unsolved e.g in toilet activities the prosthesis has to be removed Young active males accept the prosthesis well, but women over middle age who lead a sedentary life do not do well with this type of prosthesis

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SURGICAL AND DIAGNOSTIC TECHNICS

Arthrography and its uses are discussed by J Rezek[6] (Univ of Prague) Arthrography of the knee with positive contrast mediums was done on about 800 patients since 1950 Pneumoarthrography was done on about 100 patients Only as much contrast medium was used as was necessary for visualization of the soft tissues within the joint. The less concentrated mediums were preferred Pathologic changes were found in about two thirds of the knees Most patients had previous knee injury Pneumoarthrography was inadequate for visualization of fine tears in the meniscus but was adequate in osteochondritis dissecans for the demonstration of nonopaque free bodies in the joint space.

Arthrography of the knee is indicated in meniscus fractures dislocation and subluxation of meniscus fragments for localization of meniscus lesions and for visualization of collateral and cruciate ligaments Rupture of the joint capsule chronic hydrops osteochondritis dissecans and arthrotic changes are well visualized

In arthrography of the jaw joints it is sufficient to visualize the upper portion since the filling of the upper joint and

(6) Fortschr Geb. Röntgenstrahlen 89 319-331 September 1958

articular process provides enough information on the joint space and on possible changes in the meniscus Further the filling technic is simpler and more dependable. However filling of the lower joint only will visualize possible adhesions between the disk and articular process

Arthrography of the jaw joint is indicated for diagnosis of long-standing disturbances and in meniscus alterations. In several patients the iodine-containing contrast mediums were also of therapeutic help

Arthrography of the shoulder joint is performed under skiascopic control to prevent extracapsular injection of contrast material Arthrography may reveal ruptures in the shoulder aponeurosis in the area of the supraspinatus infraspinatus and subscapularis muscles

Arthrography of the elbow reveals damages in the capsule and ligaments their exact extent and location Postoperative changes in joints with limited function are also demonstrated

In ankle injuries arthrography will show damage to the joint capsule ligaments and surrounding tendon sheaths.

Acute inflammatory processes and iodine hypersensitivity contraindicate arthrography The author performed nearly 1 000 arthrographies without complications Of the various contrast mediums used he prefers Joduron and Triopac.

Femoral Arteriograms Use to Demonstrate Circulation of Hip Following Neck Fractures of Femur A E. McGinnis J O Lottes and Fred C Reynolds[7] (Washington Univ) performed femoral arteriograms in 12 patients with intracapsular fractures of the femoral neck. Eleven arteriograms were bilateral so the uninjured hip could be used for comparison In 9 patients the studies were done after internal fixation of the fracture. Preoperative studies were done in the other 3

METHOD—Under cutaneous local anesthesia 50 cc. of 35% Miokon* was injected into the femoral artery via an 18-gauge arterial needle. Puncture was made just below the inguinal ligament. Pressure sufficient to maintain a steady flow of dye for about 5 seconds was used. A tourniquet was not placed below the area of injection. Films were taken when all but 5 cc. dye had been injected. (Fig 193)

There were no reactions or complications to the procedure. The arterial patterns in these patients were similar to those

(7) Missouri M d 55 31 34 January 1958.



Fig. 193—Adequate visualization of femoral artery and branches. (Courtesy of McGinnis, A E et al Missouri Med. 55 31 34 January 1958.)

described by Missbichler No prognostic conclusions concerning alteration of the arterial circulation about the hip after fracture and operation could be drawn from this small series with inadequate follow up When the circulation appears equal to or greater than that in the uninjured hip the chances are better for union and a viable head

Compression in Arthrodesis Comparative Study of Methods of Fusion of Knee in 93 Cases was made by Marcus J Stewart and W Griffin Bland[8] (Univ of Tennessee) Conventional methods were used in 63 cases and the compres

(8) J Bone & Joint Surg 40-A 585-606, June, 1958.

sion method in 30. The average time required for clinical and roentgenographic union in the compression series was less than half as long as in the conventional series. Ambulation was also much earlier in the former. In patients with difficult conditions such as tuberculosis, union was obtained by the compression method. With the conventional method, union occurred in only 75%.

Cortical bone grafting or the addition of bone chips was not necessary in compression arthrodesis, but in most operations the patella was used as an anterior bridge. It is denuded of all cartilage, then placed in a prepared bed in front of the femur and tibia, thus bridging the joint space. Postoperatively, the patients were usually quite comfortable and were allowed to leave the hospital in 7-10 days.

Four patients had Charcot's disease. In the 2 treated with compression fixation, union was slow, whereas the 2 treated by conventional methods had nonunion.

In patients with severe fractures involving the knee, union took longer than the over-all average. This was probably due to the sclerosis resulting from trauma and impaired blood supply.

Chapchal's method of intramedullary fixation across the knee joint was not used, but his principles are in accord with the contemporary concepts of the requirements for arthrodesis and fracture healing. In 1 patient treated by the Henderson technic (parallel Knowles pins), union was prompt.

When the compression apparatus is used correctly in arthrodesis of the knee, the patient is spared much morbidity, discomfort and disability. This technic appears to have many advantages over the conventional method, both for patient and surgeon.

Knowles Vertebral Support Operation. F. L. Knowles[9] (Fort Dodge) describes the technic for this procedure.

TECHNIC.—The patient is placed on his left side on an x-ray cystoscopic table in a tight knee-chest position, with the knees braced against the upright x-ray support, cushioned by a pillow. The patient can be anchored in this position by tying the end of a roll of cloth 5 yd. long and 6 in. wide to the base of the x-ray support, then passing the cloth beneath the patient's left shoulder and back around the x-ray support, drawing the wide bandage tight and fastening it with a half hitch, then passing it around the feet and back around the half hitch and finally passing it over the horizontal x-ray support, whereas with the patient's right arm raised, it is tied around the

(9) J. Iowa M. Soc. 48:551-554, October 1958.

wrist and hand. With the right arm and hand raised high, ample breathing excursion for the chest is assured. Pentothal® sodium and nitrous oxide anesthesia should be given, the back prepared and the patient draped. After the 5th lumbar interspace is located, a stab wound is made through the skin and posterior spinous ligament. A hemostat is then inserted through the ligament. A lateral x ray is taken, the film for which was in place before the patient was draped. The x ray film will confirm whether the hemostat is at the proper interspace. The incision is now lengthened to about 1¼ in., and the posterior tendon incised lengthwise between the 5th lumbar and 1st sacral vertebrae by cutting upward close to the 5th process and downward close to the 1st sacral process. The wound is packed to stop the bleeding.

A vertebral support is inserted between the posterior spinous processes, removed and a longer support pushed in. As each longer support is pushed into place, the disk space is gradually widened. Each successive support should be driven in as tight as possible, and if it still can be moved, it should be replaced with a larger size until considerable force would be required for its removal. Good placement between the posterior spinous processes can be determined by sense of touch and confirmed by a lateral x ray. Particular care should be exercised so that the support does not impinge on the spinal canal.

Double no. 1 catgut is used to close the posterior ligament and 2 dermal skin sutures to close the wound. A dry 4 × 4 dressing is applied.

This procedure was done on 360 patients. The first 200 were sent a questionnaire and 167 replied, 90% of whom reported considerable improvement.

Operative Procedure for Pilonidal Cyst and Sinus is presented by Wm. F. Martin[1] (Charlotte, N. C.). A pilonidal cyst and sinus consist of an epithelial lined pocket with one sinus or more. The pilonidal cyst, congenital in origin, is located in the midline of the sacrococcygeal region, superficial to the sacrococcyx structures. It represents remnants of the obliterated lower portion of the neural canal or an invagination of the surface epithelium. The defect manifests itself usually in the 2d and 3d decades.

It may be a painful or painless sinus or swelling generally located in the sacrococcygeal region. It exudes a foul smelling discharge which is persistent or intermittent. Symptoms may be like those of a boil or abscess.

Among 162 cases of pilonidal cysts and sinuses, 77 were treated by the primary closure and operative method. After removal of the sinus, the cyst and skin were removed en bloc, including the sacrococcygeal fascia and the gluteal mus-

(1) Am. Surgeon 23: 1109-1114, December, 1957.

cles and fascia were undermined over the sacrum for 1½-2 in on each side, purposely everting the skin edges. Patients were given combined antibiotics and sitz baths twice daily The average hospitalization was 26¼ days

When a pilonidal cyst and sinus are abscessed, it is best to do a crucial incision and curet the cyst and sinus tract along with the infected granulated areas After the tracts are curetted, the skin edges are sutured down to the sacrococcygeal fascia and packed with iodoform gauze in the manner advocated by Carrington.

TECHNIC.—An elliptical incision with a sharp inverted "V" is made at the upper angle to prevent puckering when the wound is closed. Skin, sinuses and cysts en bloc are excised down to and including part of the sacrococcygeal fascia. The gluteal muscles and fascia are undermined sufficiently to permit their approximation over the sacrum and coccyx without tension Hemostasis is best controlled by suture ligatures, hot packs and pressure. The muscles and fascia are approximated by interrupted no. 1 chromic catgut sutures, bringing the gluteal muscles and fascia over the sacral and coccygeal regions by passing the sutures through the muscles and fascia, including a small portion of the sacrococcygeal fascia. Muscles and fascia should not be sutured with any tension over the sacrum. The superficial fascia is closed with interrupted 00 plain catgut, assuring good hemostasis and approximation without tension, filling in all dead spaces with muscle and fascia. The skin is closed with 000 or 00 black silk mattress sutures, purposely everting the skin edges. This method of closing is designed to prevent epidermal cells from migrating downward and often causing as Womak believes recurring sinuses.

This method shortens healing time, gives a pliable muscle pad over the sacrum prevents painful and large scars and closes all dead spaces Numbness persists in the incisional area for several weeks after surgery

In 85 patients treated by this method 2 had recurrences. The so-called recurrence of pilonidal cyst and sinus is not due to the remnants of pilonidal tissue. It is caused by dead spaces which have not been obliterated by poor hemostasis, by lack of proper preparation of patients before surgery by not everting skin edges to prevent downward migration of epidermal cells or by poor postoperative care.

► [Definitive primary surgery with primary closure, as described by the author prevents months of morbidity A granulating open wound will heal slowly and the redundant scar tissue may subsequently require plastic revision.—Ed.]

Roentgen Method of Evaluating Density of Bone is described by Stanley B Reich Joseph Levitin and Leland R.

Felton[2] (Mount Zion Hosp San Francisco) After 30% de calcification of nonmacerated bone demineralization can be suspected by x rays Loss of 50% was necessary for the x ray findings to be unequivocal Therefore many cases of border line demineralization are missed and it is extremely difficult to follow the effect of treatment on obvious demineraliza

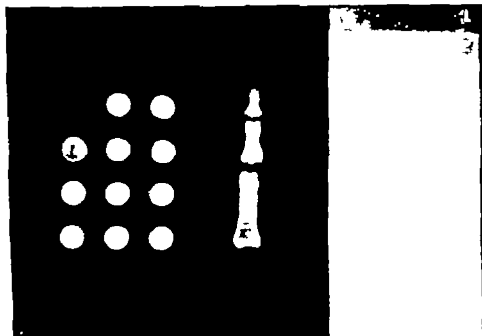


Fig 194 (Courtesy of Reich, S B., *et al*: Am. J Roentgenol. 79 705-708 April, 1958.)

tion The authors developed a roentgenographic-densitometric method for estimating calcification of phalangeal bones

METHOD.—X rays are taken of the hand submerged in a fixed depth of water in a machined aluminum pan with a 1 mm. base. An aluminum step wedge and a calcium chloride wedge are submerged in the same pan (Fig 194) The calcium chloride wedge is made by drilling round holes 1 cm in diameter in a 1 cm. deep Lucite block These are filled with graded solutions of calcium chloride and each surface is closed with cover glasses. The simultaneous exposure of wedge and bone eliminates much of the difference in development, emulsion and exposure inherent in any two-film method.

The submersion of the part and wedges in water minimizes the correction necessary for soft tissue density The only difference in absorption is caused by the slight relative radiolucency of fat. Under

(2) Am. J Roentgenol. 79 705 708, April, 1958.

the conditions of this experiment the opacity in a finger with soft tissues is about 2% less than the isolated bone.

Opacity of the film was measured by a Kodak color densitometer of the diffusion type Each reading covered an area 1.25 mm. in diameter Nonscreen film was used because it registers greater range of density than does screen film The lateral proximal medullary portion of the 2d phalanx of the index finger was chosen as a standard. This area was easily reproduced in a film and represents two relatively thin cortices and medullary bone superimposed.

The opacities of the calcium standard are plotted on a graph. The aluminum wedge is plotted as a check. The density of the bone is plotted against the curves of standard. The equivalent density in mil-

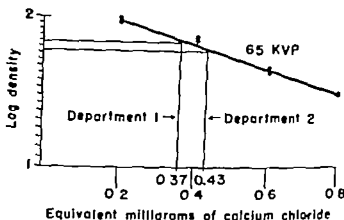


Fig 195—Result of changing x-ray and dark-room technics (different radiologic departments) (Courtesy of Reich, S. B., *et al.* Am. J Roentgenol. 79:705-708, April, 1958.)

ligrams of calcium chloride in solution (or millimeters of aluminum) is obtained. It is possible to refine this to equivalent milligrams of calcium/cubic millimeter of bone scanned. The effect of kilovoltage was evaluated by taking x rays of phalangeal bones submerged in the apparatus and altering the kilovoltage. The variation was under 2% over a 20 kv range.

The same setup was moved to another x ray department and similar films obtained. The variation with change of x ray machine, exposure and development was about 14% (Fig 195) Subsequently the bones of the phalanges were split. One-half was analyzed for milligrams of calcium/cubic millimeter of bone the other half was partially demineralized and x rayed again. Densitometric estimates of its mineralization were obtained. The partially demineralized bones were chemically analyzed for milligrams of calcium/cubic millimeter of bone. The results indicated that the method of x ray estimation of calcification is capable of picking up changes of about 15%.

INSTRUMENTS APPLIANCES AND BONE BANKS

Cryodesiccation for Preparation and Preservation of Bone for Bone Bank. P Stagnara, T Dubost Perret J Schnepp, F Valentin and A Larcher[3] report a series of experiments attempting to apply Hyatt s work on cryodesiccation of homotransplants to heteroplastic material from dogs The method which provided the best criteria for evaluation of transplants was resection of 6 cm of the diaphysis in the dog and bridging this resection with the transplant fixed at both ends by osteosynthesis and maintained by a screw or loop of atoxic wire

When this procedure was utilized for heteroplastic transplants treated by simple refrigeration failures were about 50% Delayed take led to pseudarthrosis and satisfactory filling of lost bone substance did not occur

Cryodesiccation (drying in a vacuum at very low temperature) of bone is difficult compared with the treatment of biologic material in suspension or solution Hyatt s procedure requires a 14-day treatment of bone fragments in a cryodesiccation chamber of the Stokes type. The authors' first trials with bone so treated yielded some instances of rapid assimilation (Fig 196) To save expense, a more rapid process was subsequently devised.

Satisfactory desiccation requires a final warming temperature of 32 34 C Weight loss of a specimen was 33% and rehydration appeared difficult. Even after 24 hours of immersion a tinted solution did not penetrate more than 2 mm. A saw or drill was difficult to use on this bone and caused considerable heating Experimental transplants after diaphysial resection were unsuccessful in all instances The bone was absorbed in less than 4 months being dissolved by enzymes. The intense processing of these bone sections removed the water of imbibition as well as that of molecular composition. Organic salts in the bone must have been changed profoundly to become soluble by tissue enzymes

Further experiments led to a new procedure of cryodesiccation with 89 hours of treatment and limitation of terminal

(3) Lyon chir 53:846-856, November 1957

warming temperature to 24 C These specimens lost only 14-16% weight and rehydration yielded approximately the same structural characteristics as those of fresh bone. Their experimental use was successful

For 3 years bone prepared in this way has produced satis-



Fig 196 —Cryodesiccation—first trials. Good results with resection and transplantation radiologically verified on 155th and 435th days. (Courtesy of Scaglietti, P et al)

factory reconstruction of diaphysial resection of the radius. In 2 months the entire transplant is in a process of generation and within a year filling is complete and cortical bone function satisfactory

Bone prepared by cryodesiccation has been used in 5 cases of scoliosis for arthrodeses of the 8th to the 11th vertebrae, and results in all were satisfactory 3 years later

Fig 197.—Cortical bone transplants showing fragments in section of diaphysial cortex of radius of dog *A* longitudinal section of control autoplastic transplant. *B* cortical calf-bone transplant from same radius of receptor animal killed on 28th day after surgery (Courtesy of Stagnara, P *et al* : Lyon chir 53 846-856, Novembe 1957)

Fig. 198.—Transverse section. *A* transplant of calf bone treated by simple refrigeration showing regeneration at only one angle. *B* transplant treated by cryodesiccation in same animal killed on 28th day showing regeneration already deeply penetrated and assimilated. (Courtesy of Stagnara, P., *et al.*: Lyon chir 53 846-856 November 195)

Histologic studies show that assimilation of a control autotransplant and a heteroplastic transplant treated by cryodesiccation occurs in the same time (Fig 197) but with qualitative differences Autoplastic bone is assimilated without structural change whereas treated heteroplastic bone undergoes significant changes Histologic sections of the latter show areas with a Gruyere cheese appearance in which zones of resorption and regeneration of new bone are relatively larger than those in the controls When this rate of assimilation is compared with that of heteroplastic specimens simply refrigerated at —70 C the time required is two to three times as long in the latter (Fig 198)

Function of Donor Tissue in Experimental Operations with Radioactive Bone Grafts was investigated by Marshall R. Urist Norman S MacDonald and Jenifer Jowsey[4] (Univ of California Los Angeles)

METHODS.—Seven rabbits were given injections, intraperitoneally of Ca^{45} Sr^{90} or Y^{91} carrier free as chlorides in various doses. The donors were killed 1 2 weeks after injection to insure sufficient time for the isotope to become firmly fixed to the bone mineral Blocks of bone from the femur or tibia containing both spongiosa and compacta, were cut into rectangular pieces with a wet weight of about 100 mg The specimens were wrapped in silver foil, refrigerated at —30C., and allowed to thaw In one experiment the donor tissue was transferred fresh without refrigeration. The approximate amount of radioactivity was estimated in each sample with a Geiger Muller counter

Thirty two bone grafts were performed under ether using immature rabbits as clean hosts. A drill hole 3 mm. in diameter was made through a small incision on the anteromedial aspect of the tibia, extending obliquely into the proximal metaphysis and down toward the shaft. The radioactive isotope labeled tissue was packed inside the metaphysis until it was tightly in contact with trabecular bone of the host on all sides The hosts were killed 1 112 days after operation and the tibiae studied. The whole bone was x rayed, studied and cut into slices 1 3 mm thick with a rotary saw A slice containing part of the graft (100 μ thick) was sectioned while undecalcified on a lathe and prepared for microradiographs and microautoradiographs. Another similar slice (10 μ thick) was decalcified and sectioned for histologic staining with azure II toluidine blue, and for the Hotchkiss procedure for mucopolysaccharides of the ground substance and cement substance.

The mechanical aspects of the intrametaphysial bone graft operation made it virtually impossible for the donor tissue to escape contact with bone of the host. One week after opera

(4) Ann S r 147 129 145 February 1958.

tion the donor tissue was found in the center of the bone in the area between the metaphysis and the shaft known as "the funnel" In 2 3 weeks the donor tissue had attached to the posterior cortex and was reduced in size by absorption whereas the epiphysis grew away from the area of operation In 4-6 weeks the marrow cavity was restored the donor tissue had become incorporated in the posterior lateral wall of the cortex and the epiphysis had grown a distance of 3 5 mm away from the radioactive donor tissue.

Donor tissue can accomplish its purpose (induce the host to fill a defect fuse a joint or unite a fracture) when less than a third of its total mass has been absorbed and replaced by the host The bone matrix and mineral are absorbed together and the labeled mineral constituents are dissolved and carried into the systemic circulation of the host not transferred locally to the host bed When a bone graft "takes" the donor tissue becomes joined to the host by a cement line formed by the host through condensation of mucopolysaccharides with the histochemical characteristics of chondroitin sulfate When a bone graft operation fails the donor tissue does not become attached by a cement line to new bone produced by the host instead it becomes encapsulated in an envelope of fibrous tissue and is virtually outside the body In a successful bone graft the host grows into the donor tissue in an orderly pattern not haphazardly The trabeculae of new bone from the host bed grow into the donor by attaching in the most efficient way to a trabecula of dead bone Thus the function of donor tissue in all bone graft operations is to provide a network of slowly absorbed surfaces on which the host can condense the cement line and deposit the new bone. New bone formation by such a transfer is a nonspecific reaction the mechanism of which is not yet known and requires further investigation

► [This is an interesting and significant experimental study The technic described has helped to demonstrate the interaction of donor and host bone tissues —Ed.]

Radiation Sterilization of Homogenous Bone Transplants Utilizing Radioactive Cobalt Preliminary Report is made by Paul H DeVries Carl E Badgley and J Ted Hartman[5] (Univ of Mich) When combined with a freeze-drying process this method proved effective for maintaining a bone bank

(5) J Bone & Joint Surg 40-A 187 203 January 1958.

METHOD.—Both iliac crests are removed from bodies known to be free from infectious and neoplastic diseases. The bone is stripped of all soft tissue, and cut into the desired shapes and sizes by a heavy duty band saw. The bone is washed in ordinary tap water to remove accumulated dirt and debris. This vigorous washing under running water removes much of the marrow from the thin strips of ilium. Some of the iliac strips are cut into smaller pieces in a bone mill. After cleaning, cutting and washing, the bone is placed in Pyrex tubes and the large open ends of the tubes are sealed. The tubes are immersed in a mixture of dry ice and alcohol for about 20 minutes, after which they are affixed to the vacuum apparatus. About 14 days are required to remove most of the water from the bone, but if there is immediate need for the transplant, the process can be terminated 24-48 hours after starting the drying process. To remove the tubes from the apparatus, a gas-oxygen torch is used to seal the small end while the pump is running. The tubes of bone are then taken to the radiation source and subjected to sterilization of 4 000 000 rep. The tubes can be stored at room temperature.

The radiation source used consists of 100 aluminum-jacketed cobalt rods stored in a water well within a concrete cave. The concrete cave is large enough to allow irradiation of large quantities of material. After the material is placed in the cave, the radiation source is raised from the water well into the radiation chamber by a remote control winch. After proper time has elapsed, the source is lowered into the water well and the irradiated material can be removed from the radiation cave with safety.

This method produces sterile bone that is easily stored and transported. The tubes of bone retain no residual radioactivity. Depending on the size of the radioactive source, a dose of 4 000 000 rep can be administered in 6-24 hours. Electron accelerators can administer 4 000 000 rep in a few seconds but have the disadvantage of low penetrability, thereby preventing sterilization of large pieces of bone sealed in glass or metal containers. The ionizing radiation from radioactive cobalt has high penetrability, thereby eliminating this undesirable feature.

Irradiated bone transplants functioned satisfactorily experimentally and clinically. In 104 procedures in which irradiated homogenous bone transplants were used, 5 postoperative wound infections occurred. The irradiated bone transplants were not believed to be the source of these infections.

CALCIUM AND PHOSPHORUS METABOLIC DISEASES OF BONES

Hypocalcemic States in Infancy and Childhood are described by Donald Gribetz[6] (Mount Sinai Hosp, New York) Hypocalcemia may manifest itself by various seemingly unrelated signs and symptoms as well as by classic tetany A low serum calcium may also be associated with diseases of several different body systems

Although no longer a common cause of hypocalcemia, vitamin D-deficiency rickets occasionally may be associated with tetany especially during the healing phase of the disease. Ingestion of several chemical substances such as oxalates and citrates may cause tetany by their combination with ionized calcium in the serum thereby forming insoluble complexes Administration of large amounts of citrate during blood transfusions especially during exchange transfusions for erythroblastosis fetalis though not causing gross hypocalcemia, may cause clinical tetany The postacidotic tetany occurring during recovery from the acidosis of infantile diarrhea, is now rare due to newer methods of parenteral fluid therapy using smaller amounts of alkali In hypertonic dehydration, usually found in children with diarrhea there is hypernatremia or hyperosmolarity of the serum For some poorly understood reason a low serum calcium level appears to be directly correlated with the height of the serum sodium A low serum calcium level may depend on a low level of proteins in the serum This may be found in starvation states and in other conditions associated with hypoproteinemia, such as nephrosis Hypocalcemia of this nature rarely causes clinical symptoms since the physiologically active ionized calcium remains normal or nearly so

Defects in gastrointestinal absorption which lead to steatorrhea may be associated with hypocalcemia and tetany A combination of two mechanisms has been offered as an explanation for this phenomenon (1) unabsorbed fatty acids form insoluble calcium soaps in the intestine, thus preventing absorption of calcium from the intestine and (2) vitamin D being fat soluble is dissolved in the unabsorbed fat

(6) A.M.A. J Dis. Child. 94:301 312, September 1957

and excreted in the stool a relative vitamin D deficiency thus results Hence conditions such as congenital malformations of the gastrointestinal tract, cystic fibrosis of the pancreas and hepatic disease may so interfere with fat absorption as to produce hypocalcemia.

Two disturbances of renal function may lead to hypocalcemia (1) A diminished glomerular filtration rate, regardless of etiology, will eventually cause retention of phosphorus in the body fluids A rise in serum inorganic phosphate concentration depresses total serum calcium as well as the ionized fraction The reasons for this effect are little understood at present (2) In primary renal tubular disease there is interference with the excretion of acid metabolites from the body Instead calcium stores are mobilized for this purpose and hypocalcemia may result.

The current concept of the etiology of tetany of the newborn supposes a transient, perhaps physiologic, period of hypoparathyroidism This plus a presumed inefficiency of phosphorus clearance due to renal immaturity permits an increased concentration of serum phosphorus to develop when large phosphorus loads are fed to young infants. Such a load is presented when an infant is fed cow s milk. The etiology of idiopathic hypoparathyroidism is not known Congenital absence of the parathyroids their degeneration subsequent to trauma and infection may be factors Monilial infection has often been associated with idiopathic hypoparathyroidism but it is not clear whether such infection is a cause or a result of the deficiency of the parathyroids Low serum calcium and elevated serum phosphorus levels a peculiar physical habitus and insensitivity to parathyroid hormone compose the triad characteristic of pseudohypoparathyroidism

Prolonged therapy of hypocalcemia may be accomplished by calcium salts together with vitamin D and aluminum hydroxide gel As the serum calcium level approaches normal the aluminum compounds may be discontinued first Next the vitamin should be titrated downward and finally the calcium salts may be reduced

Osteomalacia with Emphasis on More Resistant Forms, is discussed by *Boy* Frame and Richmond W Smith Jr[7] (*Henry Ford Hosp*) Dent has emphasized that osteomala

(7) J Michigan M Soc 56 1549-1555 December 1957

cia in its many forms is sometimes genetically determined Dietary-deficiency osteomalacia, or rickets, is rare in pediatric practice today and with proper prophylaxis should seldom be seen The pathogenesis of the osteomalacia found with various types of steatorrhea is fairly well understood With defective absorption of fat there is poor transport of calcium and vitamin D This is the most frequent cause of osteomalacia in this country today Steatorrhea in patients so affected may be relatively mild and only careful balance studies will reveal an abnormal fat loss in the stool Bone softening due to hypercalciuria or hyperphosphaturia is found in idiopathic hypercalciuria and renal tubular acidosis The hyperphosphaturia of patients with the Fanconi syndrome can be so excessive as also to result in osteoid depletion and osteomalacia

In general vitamin D resistant osteomalacia has become an unsatisfactory term since osteomalacia of diverse etiologies may eventually fall into this category The osteomalacia in patients with renal tubular acidosis is resistant to vitamin D unless adequate alkali is given to correct the acidosis Similarly the osteomalacia of idiopathic steatorrhea is resistant to the vitamin unless the primary absorptive defect is improved by steroids and perhaps by a gluten free diet. Nevertheless, there are cases in which the main defect seems to be a unique resistance to the action of vitamin D Cases of vitamin D resistant osteomalacia are usually diagnosed in early childhood primarily because of dwarfism and bony deformities However adult forms have also been described. The changes in blood constituents and x ray findings are similar to those seen in osteomalacia resulting from dietary deficiencies Some patients with vitamin D resistance require 500 000-1 000 000 units daily before fecal calcium is decreased and osteomalacia is improved The unresponsiveness of these patients is not due to faulty absorption as the serum concentration of the vitamin is many times normal

Of unusual interest has been the recent description of a bone disease resembling osteomalacia in which a marked deficiency of alkaline phosphatase has been found in the cartilage, liver and serum Changes compatible with osteomalacia have been found in bone biopsy specimens from patients with this condition but, in contrast to the usual form of osteomalacia the serum calcium and phosphorus may be

elevated The exact role of alkaline phosphatase in calcification of bone is undetermined

Since large doses of vitamin D and added supplements of oral phosphorus given to patients with resistant osteomalacia have not raised the fasting level of serum inorganic phosphorus other approaches should be considered One of the most certain ways to achieve hyperphosphatemia is to remove the parathyroids Loss of the presumably hyperplastic glands would be a relatively small price to pay for potential improvement in a patient immobilized with resistant osteomalacia It is unlikely that the low serum calcium following such surgery would be more difficult to control than the preoperative hypophosphatemia

Another approach to treatment of these patients is the use of sterol preparations other than vitamin D_2, which in the past has been used almost exclusively in the therapy of osteomalacia In general the few who have explored these avenues believed there was no significant difference between the actions of vitamin D_2 and vitamin D_3 However recent work indicates that patients inadvertently deprived of the parathyroids during thyroid surgery and resistant to vitamin D_2 show a significant improvement after vitamin D_3.

Results of Metabolic Studies of Bone in Paget's Disease and Secondary Bone Cancer are reported by A Lichtwitz, S de Sèze D Hioco Ph Bordier and R Parlier[8] In Paget's disease there seems to be a biochemical factor which can produce hyper or hypocalciuria. But the hypercalciuria which suggests osteoporosis is accompanied by a definite increase of alkaline phosphatase. Likewise the hypocalciuria which would suggest the presence of osteomalacia is differentiated in Paget's disease by presence of normal blood calcium and consistently increased blood phosphorus which is never observed in osteomalacia. Existence of these unusual contrasts in phosphorus-calcium balance in an osteopathy of undetermined origin suggests the possibility of Paget's disease

The most striking biochemical finding in Paget's disease is the reduction of urine calcium by cortisone. The reaction to cortisone in all patients studied has been a reduction of calcium and phosphorus in urine and blood. This is consistent and significant but transitory lasting only 5-8 days even

(8) Semain hôp. Paris 33 4080 4085 Dec. 6, 1957

when administration of cortisone is continued With cessation of cortisone effects on phosphorus-calcium metabolism the level of alkaline phosphatase begins to change. Results of tests with calcium perfusion and administration of vitamin D_2 are of less diagnostic value because they reflect osteoblastic reaction of variable intensity according to the stage of the disease. Usually calcium which has been perfused is eliminated in the urine in lesser amount than normal though this is not always true. After administration of vitamin D_2 calciuria may diminish or increase, depending on the individual case

From biochemical investigations in 11 patients in 1 of whom quantitative calcium balance studies were done, both under static conditions and with dynamic tests over a 6-day period differentiation between static and dynamic phases of Paget s disease was made The static phase is similar to osteoporosis normal blood calcium high calciuria and increase of phosphorus in blood and urine. But increase in alkaline phosphatase precludes a decrease in the osteoblastotic process At other times calciuria is at the lower limit of normal which would suggest osteomalacia, but normal blood calcium and slight elevation of blood phosphorus are not consistent with this diagnosis The dynamic phase is either normal or of hyperosteoblastotic type retention of injected calcium and absence of significant hypercalciuria after administration of vitamin D_2

This biochemical picture reflects a disease in which two opposing processes are heightened (1) osteolysis probably of vascular origin with dispersion of endogenous calcium resulting in hypercalciuria and hyperphosphaturia and (2) acute hyperosteoblastosis with disorganized construction of osteoid tissue, causing fixation of perfused calcium and slight increase of calciuria after vitamin D_2 administration Interpretation of this syndrome is rendered more difficult because at certain stages the two processes of osteolysis and hyper osteoblastosis may coexist in almost equal intensity whereas at other times one or the other is definitely predominant.

Static and dynamic tests of phosphorus and calcium also appear increasingly significant in determining the treatment for secondary bone cancer Value of various types of therapy including estrogens androgens cortisone, radiation and hormonal surgery can be estimated to some extent by the

biochemical changes produced Spontaneous calciuria reflects cancerous osteolysis and induced calciuria indicates an osteoblastotic reaction With bone atrophy (hypo-osteoblastosis) calcium injected into the veins is largely eliminated by the kidneys When the calcium administered appears in only small amounts in the urine hyperosteoblastosis is the apparent explanation

Osteosclerosis in Chronic Renal Disease was observed by Horace L. Wolf and John V Denko[9] (Northwest Texas Hosp Amarillo) in 5 men aged 53-64 and 2 women aged 21

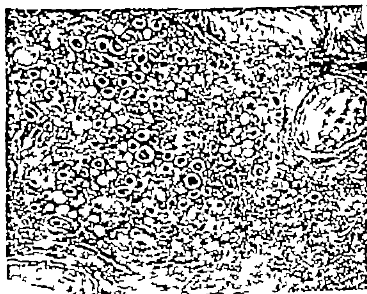


Fig 199 —Kidney of woman, 42, showing chronic sclerosing glomerulonephritis reduced from ×63 (Courtesy of Wolf H. L. and Denko, J V Am. J M Sc 235 33-42 January 1958)

and 42. All presented clinical and laboratory evidence of chronic renal disease of 5 20 years duration Chronic glomerulonephritis was diagnosed in 3 (Fig 199) and chronic pyelonephritis in 4 X rays revealed varying degrees of osteosclerosis in all The lumbar vertebrae were involved in all and the pelvis in all but 1 patient (Figs 200 and 201) whereas the thoracic cage showed changes in 5 Anemia was present in 3 patients Nonprotein (or blood urea) nitrogen was elevated in all serum calcium was low in 2 patients serum alkaline phosphatase was elevated in 1 patient and low in another and metabolic acidosis was present in 5 Autopsy on 1 patient showed secondary hyperparathyroidism

(9) Am. J M Sc 235 33-42 January 1958.



Fig 200—Osteosclerosis of iliac crest of same patient. Deeper bone spicules are thickened and irregular Hematoxylin-eosin reduced from ×63 (Courtesy of Wolf H. L., and Denko, J V Am. J M Sc. 35 33-42 January 1958)



Fig 201—Retrograde pyelogram of man, 58 with lumbar spine showing osteosclerosis. (Courtesy of Wolf H. L and Denko, J V Am. J M. Sc. 235-33-42, January 1958.)

Osteosclerosis in chronic renal disease differs from the type of diffuse bone sclerosis found in myeloid metaplasia of the spleen and panmyelosis The histologic pattern in the study patients did not show the hemopoietic alteration in marrow cells and stroma found in myelosclerosis of nonrenal origin

The authors favor the theory that osteosclerosis may occur in patients with chronic renal disease in whom varying degrees of bone absorption first developed then osteosclerosis They believe that these changes are probably related to renal metabolic acidosis

► [Few cases of osteosclerosis associated with and presumed to be caused by chronic renal disease have been described in the literature. The hypothesis suggested by Wolf and Denko and the cases reported by them will be of interest to all who are concerned with the study of metabolic diseases of the bones.—Ed.]

Gaucher's Disease Presenting as Widespread Resorption of Bone I Snapper and Arthur F Goldberg[1] (Beth El Hosp, Brooklyn) describe the symptoms and report an atypical case Gaucher cells proliferate destroying the trabecular structure of the cancellous bone resulting in a moth-eaten appearance of the involved skeletal part. The cortex of the bone is also thinned and even eroded by the onslaught of these cells In the later stages of the disease partial sclerosis of the lesions is sometimes seen New bone may be formed within the medullary cavity of the affected bone due to secondary calcification of collagenous fibers in the old lesions In an x ray the affected bones appear mottled and moth eaten Periostitis rarely occurs nor is the articular cartilage invaded by Gaucher cells In older persons nonspecific osteoarthritic changes complicate the Gaucher cell degeneration. The bones may ache and spontaneous fractures may occur

Proliferation of the kerasin laden histiocytes often causes the affected bone to enlarge This enlargement is most marked in the distal part of the femur The waistline of the lower femur disappears and a bottle or club-shaped deformity of the metaphysial area results The latter is usually referred to as Erlenmeyer flask appearance of the femur

The same proliferation of Gaucher cells may debilitate the neck of the femur As a secondary effect aseptic or avascular necrosis results allegedly due to embolization of blood vessels by Gaucher cells This under influence of mechan

(1) J Mt Sin H p New York 24 1221 1230 Nov Dec., 1957

ical stresses and weight bearing leads to partial collapse of the femur neck and resorption of the acetabular bone Ultimately an x ray picture of the deformity of the femoral head may resemble that of a severe form of osteoarthritis

In younger persons the avascular necrosis leads to bilateral coxa vara mushrooming of the femur heads and widen

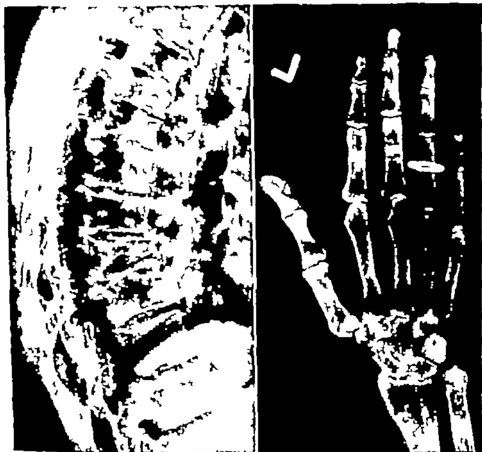


Fig 202 (left) —Generalized resorption of bone of thoracic spine. Marked compression and wedging of 9th dorsal vertebra and compression of 5th and 6th dorsal vertebrae. Intact pedicles and intervertebral disks.

Fig 203 (right) —Marked resorption of bones of hand, with paper-thin cortex of all phalanges and 1st, 4th and 5th metacarpals.

(Courtesy of Snapper, I., and Goldberg A. F J Mt. Sinai Hosp New York 24 1221 1230 Nov Dec., 1957)

ing and shortening of the femur necks In such patients Gaucher's disease presents as Legg Perthes disease, or osteochondritis juvenilis deformans. There is however one difference. In Legg Perthes disease the epiphysial growth nucleus is normal before osteochondritis begins In Gaucher's disease the epiphysial center is never completely normal Comparable lesions are sometimes present in the neck

and head of the humerus in the pelvis and in the spine. In some cases of Gaucher's disease the lumbar intervertebral disks widen with partial collapse of the vertebrae. In others, the vertebral lesions lead to gibbus formation causing the disease to be erroneously diagnosed as tuberculosis. This error can usually be avoided because in tuberculosis the intervertebral disk is destroyed whereas in Gaucher's disease it remains intact.

Woman, 65, had Gaucher's disease without palpable spleen or liver, without pinguecula, anemia, leukopenia, thrombopenia, hemorrhagic tendency or increase in the acid phosphatase of the serum. The presenting symptoms were severe back pains, often culminating in paroxysms of excruciating girdle pains. The pains were caused by marked resorption of bone in the vertebral column, resulting in compression of several vertebrae (Fig. 202). None of the so-called characteristic bone lesions of Gaucher's disease were present. The earlier diagnosis of postmenopausal osteoporosis proved erroneous when new x-rays revealed that the resorption of bone also affected the rest of the skeleton (Fig. 203). The diagnosis of Gaucher's disease could be made only by a bone marrow puncture.

GERIATRIC ORTHOPEDICS

General Principles of Fracture Management in the Aged are evaluated by Edgar M. Bick[2] (Mount Sinai Hosp., New York). No technics yet developed are especially applicable to the treatment of fractures in the aged. There are only limitations of objectives conditioned by the limited strength and resiliency of the musculoskeletal tissues in older persons. Relative to fracture therapy, these limitations indicate, first, a greater need for a rest period between emergency care and definitive treatment. Manipulation or surgery is best performed after a patient has had time to recover from the shock of trauma. This is generally true of all patients; it may be vital in the aged.

A second limitation is the relative softness or compressibility of the bones. Aging bone does not withstand the internal pressure of screws, plates or nails as readily as does more viable bone. Local erosion is more apt to allow the metal to loosen or cut through cortex. As this factor is variable, it does not necessarily contraindicate the use of internal

(2) Surg., Gynec. & Obst. 106:343-346, March, 1958.

fixation However it should be understood that such procedures are less dependable in the aged than in other persons For similar reasons forcible manipulation may destroy fracture surfaces to a degree more deforming than would occur in a less perfect though adequate reduction This too cannot be quantitatively expressed

A third limitation appears during the period of after-care A chief obstruction to early return of function in older persons especially in the common fractures at or near the joints is the normally decreased elasticity of the muscular and periarticular connective tissues This decrease is histologically demonstrable. It implies easy postfracture strain of inelastic ligaments capsules and fascial planes It is necessary therefore to temper the urge for early and rapid mobilization by measures which may cause excessive stretch to the tissues of an older person Often enthusiastic attempts at exercise or self stretching of the affected area result in a pain spasm sequence which retards rather than enhances mobility A good rule in the management of postfracture rehabilitation of the aged is to encourage daily increased purposeful activity in place of formal exercises

In elderly patients with shoulder fractures the recovery of reasonable mobility is slower than is generally anticipated Attempts to accelerate the process by active exercise not only may retard motion but also may cause unnecessary persistence of pain Daily practice in attempting the ordinary activities of the arm will probably be more successful

Reparative osteogenesis is basically a problem in protein metabolism and is only incidently related to the secondary deposit of bone salts This observation is based on the questionable value of hormone therapy in fractures of the aged No convincing evidence has been found of any increased trabecular density even when androgens and estrogens were used in cases of senile osteoporosis. However since the purpose of administering androgens in such instances is to save or retard the resorption phase of the protein matrix x ray film densities cannot be used as an index of their function Although during hormone therapy a clinically apparent sense of well being was experienced by some patients in the group studied no specific effect on the rate or quality of bone repair was observed

► [In this article Bick warns that too enthusiastic attempts to force ambu

lation of aged patients or to compel them to engage in vigorous exercises may lead to disastrous results. This may be more harmful than neglect at bed rest.—Ed]

Rehabilitation of the Elderly Double Above-Knee Amputee Milton Lowenthal Abraham O Posniak and Jerome S. Tobis[3] (New York Med. College) studied 49 patients with double above-knee amputations Mortality rate during the 5 year study was 29% About 40% survived 3 or more years beyond the second amputation Average age at the second amputation in the entire group was 67 5 and average age at death was 72 5 Survival of 5 years beyond the second amputation is adequate to justify the rehabilitation efforts.

In selecting the knee amputee who is likely to succeed in ambulation the physiologic age and associated medical conditions are the paramount factors to be considered. Any impairment in upper extremity function special sensory loss, such as blindness hip flexion contracture beyond 10-15 degrees and advanced senility are contraindications for ambulation Sex differences in attitude toward wearing pylons is reflected in the fact that all eligible female patients refused to consider stubbies

In caring for elderly bilateral above knee amputees the procedures appropriate for the rehabilitation of any lower extremity amputee are used These include stump conditioning prevention of contracture by active and passive range of hip motion when contracture is present its treatment by passive stretching preparation of the upper extremities by graduated resistive exercises for carrying the weight on crutches proper fitting of the prosthetic appliance training in balance ambulation in parallel bars and with crutches including stair climbing Rehabilitation should be completed 1 month after the prostheses are properly fitted

The standard wheel chair depends on presence of the lower extremities for proper balancing If an amputee chair is not available suitable weight (15-20 lb) should be suspended from the front frame of a standard chair

Rehabilitation of the Aged Amputee. Bror S Troedsson[4] calls attention to the increased number of amputations being done in aged patients as a result of the increasing incidence

(3) Arch. Phys. Med. 39 290-295 May 1958.
(4) Geriatric 13 180-189 March, 1958.

of arteriosclerotic obstructive disease Because of general debility and concomitant diseases restoration of the patient's functional capacity is often a complicated problem and requires the combined efforts of many persons The aged amputee generally has limited resources some or all of which has been spent on previous hospital and medical care and



Fig. 204—Man 61, with left midthigh amputation fitted with a suction socket prosthesis, learning to climb ladder preparatory t resuming work as sheet-metal worker (Courtesy of Troedsson B S Geriatrics 13 180-189 March 1958.)

he is faced with the expense of an artificial limb and the problem of how to get along outside the hospital in his own environment and in society

At the Veterans Administration Hospital in Minneapolis a prosthetic appliance clinic team is organized to solve the problems of the aged amputee. The aim of the team is to make the hospital stay as short as possible insure a suitable and useful prosthesis restore the patient to maximum activity guide him to suitable work or occupation and place

him in a favorable environment. The team includes an orthopedic surgeon specialized in artificial limb prescription a physiatrist with particular interest in vascular disease and amputation rehabilitation physical corrective and occupational therapists a social service worker a vocational counselor and prosthetists representing limb manufacturers

Before operation oscillometric tests are done to determine whether amputation is necessary and if so what is the best site The patient is instructed in pre and postoperative exercises and is given some idea of the kind of prosthesis he will be using and how long it will take him to walk again. This psychologic preparation for loss of limb is of great benefit It is even better to have the patient observe other amputees and see how well they manage. With modern treatment methods and wide choice of prostheses most aged amputees can regain a wide measure of functional capacity (Fig 204)

► [Before developing the team approach for rehabilitating the amputee, most prosthetic appliances were never properly used. Neither the limb maker or fitter nor the surgeon who prescribed the prosthesis had the time or training to be able to teach the amputee how to use with skilled efficiency his new arm or leg. Most of all the aged amputee needs the help of the prosthetic appliance clinic team.—Ed.]

MISCELLANEOUS

The Speeding Ambulance It would take 10 minutes for an ambulance averaging 30 miles an hour to travel 5 miles. To save 5 minutes 60 miles an hour would be necessary George J Curry and Sydney N Lyttle[5] (Hurley Hosp Flint Mich) found that in 2 500 consecutive ambulance runs this time interval would not have influenced the course of a single injury In only 1 instance could a moderate delay in transportation have resulted in death that of a child aged 4 with fractures of the voice box and upper trachea and bilateral pneumothorax. The total time between dispatch of the ambulance and arrival at the hospital was 12 minutes

Of the 2 500 persons transported by ambulance 27 were dead on arrival and 13 died in the emergency receiving department None of these persons would have survived even if the injuries had occurred on the hospital doorstep

(5) Am [illegible] 95 507 511 April, 1958.

In only 45 instances was the interval between the accident and arrival at the hospital considered significant Expeditious handling of the patients was desirable but a speeding ambulance was considered unnecessary A weaving siren screeching ride to the hospital might have produced death or invalidism in 9 These included 7 with multiple rib fractures unstable rib cages and pneumothoraxes and 2 with fracture-dislocations of the cervical spine The other 36 persons were in severe shock on arrival as a result of multiple fractures and internal injuries

Drivers of ambulances transporting the injured should observe the local speed laws Sirens should be used and the vehicle should have the right of way in traffic Panic by the uninformed is behind the widely held fallacy that speed in getting the injured to the hospital is all important Immediate care may be vital but speed merely increases the accident hazard.

► [This is a most timely article. As a medical student I rode the police ambulance a few times. Later as an intern and resident I took my turn as ambulance surgeon. There was not a single trip that I made which required or justified *speed* but we always roared in and out of traffic, through red lights and stop streets The patient in an ambulance should be handled most gently The ambulance should be driven *slowly* avoiding all jolts sudden turns etc., insofar as possible. My experience and observation have convinced me that the speeding ambulance causes many injuries and deaths Rarely does it ever save a life. Perhaps ambulance drivers seek these jobs because they are inhibited "hot rod" enthusiasts with a compulsion to drive wildly and recklessly If so, the law should stop this absurd and dangerous threat to the lives of patients and onlookers.—Ed.]

Care of Patient with Multiple Injuries is discussed by Otto E Aufranc[6] (Harvard Med School) Efforts should first be directed toward relieving the causes of asphyxia and then to treatment of sucking chest wounds maintenance of a free airway arrest of hemorrhage and replacement of blood splinting of fractures and finally debridement of the contaminated wounds While a patient is unconscious on a stretcher no harm can come from carefully and simply splinting all extremities When combined abdominal and thoracic injuries are encountered the latter should be taken care of first.

Every physician who treats be prepared to institute eme any part of the body He may cialist but he can often do a

(6) J.A.M.A. 168:2091 2094 Dec. 2[illegible]

cus and blood from the nose and throat stop sucking chest wounds, give intravenous fluids and blood and adequately splint badly mangled extremities

Most traumatic lesions alone do not present a serious therapeutic problem but when encountered with other complications they create a major surgical problem An open reduction may be advisable for a single injury but with multiple injuries it may be contraindicated Debridement of open wounds reduction and immobilization of fractures early amputation of all devitalized parts and other procedures all play a major role in rehabilitation of the badly injured patient Early grafting or suturing of major blood vessels may be much more important as a first procedure than fixing the fracture properly

The prevention of infection should not be overlooked by the orthopedic surgeon in managing the injured patient. The use of a broad spectrum antibiotic and whole blood, debridement of devitalized tissue and the use of prophylactic antitetanic serum and toxoid therapy are all essential for good recovery

Orthopedic Management of Severely Injured Patient is described by H Relton McCarroll[7] (Washington Univ) The severely injured patient can best be cared for by the team concept. After asphyxia obvious hemorrhage and shock have been adequately controlled, the patient should be evaluated as a whole for evidence of possible multiple injuries Severe injuries to certain parts of the body such as the head and chest or rupture of the abdominal viscus or of a major vessel represent surgical emergencies and take precedence over injuries to the musculoskeletal system as a rule. When these are present surgical consultants in the appropriate fields should be called, and definitive therapy directed toward the orthopedic injuries should be delayed until these are adequately cared for During this period the injured musculoskeletal parts should be adequately protected with pressure dressings and splints or traction

A compound fracture represents a true surgical emergency ... antibiotic therapy should be started in the emer... continued postoperatively Tetanus an... tanus toxoid should be given A pro... um welchii (gas bacillus) an

titoxin should also be given When the associated injuries to other parts of the body are mild the compound fracture should receive definitive treatment as soon as asphyxia and shock have been adequately controlled In serious injuries to other parts of the body the compound fracture should be thoroughly cleansed by washing with soap water and isotonic sodium chloride solution A sterile dressing should be applied followed by a massive pressure dressing after which a plaster cast is added to immobilize the extremity When injuries to other parts of the body are relatively mild definitive treatment for the compound fracture can be carried out as desired The patient should be taken immediately to the operating room after shock and asphyxia have been adequately controlled temporary dressing and splinting applied x rays obtained and sufficient blood prepared for protection during the operative procedure

The patient should be anesthetized with a general anesthetic If the compound fracture is in the distal portion of an extremity a pneumatic tourniquet may be added to a higher level in most instances The protective splint and dressing should be removed and the extremity held in a stable position by manual traction distal to the point of the fracture. A small sterile dressing should be held over the compound wound the adjacent portion of the extremity scrubbed thoroughly with soap and water and the area shaved The extremity is then draped for surgery The compound wound is enlarged to the desired degree to adequately expose the underlying fracture and again thoroughly irrigated with sterile saline solution to wash out any clots or foreign material

If a defect is found in the tendons nerves or any major vessels it is repaired as simply as possible In fractures that are severely comminuted, fragments may be found completely free with no remaining soft tissue attachment. These fragments may be completely removed from the wound and thoroughly washed in a basin of sterile isotonic sodium chloride solution. The wound is again irrigated with saline solution and the multiple fragments are realined The smaller fragments if found to be clean can be replaced because they may actually serve as free bone grafts across the fracture site Debriding is important as far as any damaged or devitalized soft tissue structures are concerned It is important to preserve as much overlying skin as possible If adequate skin

remains the wound may be safely closed in many fractures of this type. If surgery can be done within the first 8-12 hours often primary closure of these wounds may be safely attempted

In some compound fractures internal fixation may be required Metallic internal fixation should be used with great caution it should be added when adequate alinement and secure fixation of the fracture are otherwise impossible.

Discussion on Management of Mass Casualty Situations in Time of War[8] is introduced by Alexander Drummond. The forward surgeon s role is the preparation of wounds for delayed primary suture in 5-7 days The steppingstones to this are efficient debridement and firm support of traumatized muscles in the same manner as fractures are cared for If these principles are adhered to formation of scar tissue is minimized compound fractures are converted into simple ones and the patient s limbs and life are not jeopardized To insure this standard of treatment the more experienced surgeons must be posted to forward units to supervise those with less skill Medical and nursing personnel at hospitals and field units must be protected from being swamped by an influx of minor casualties or unsuitable operative risks They must also be organized to prevent fatigue and overwork.

That a system of casualty sorting is needed to be applied well forward of the hospitals to the whole accessible periphery of a nuclear explosion is emphasized by T M R Ahern. Sorting is the process of dividing the injured into categories so that they can be properly routed for early emergency treatment or on to medical installations appropriately situated and equipped for their care

Study of the effects of nuclear weapons suggests that 40% of the casualties can care for themselves after first aid treatment About 20% will need immediate lifesaving surgery or transportation another 20% can await treatment until they reach hospitals farther back The other 20% are unlikely to survive evacuation or to benefit from treatment From these sorting categories and a rough forecast of the proportions in which they are likely to occur an appropriate filter unit can be planned to meet the requirements. The filter unit should comprise 10 doctors 120 nurses and nursing auxil

(8) Proc Roy Soc Med 50 967 976, November 1957

iaries and 160 nonskilled people to act as stretcher bearers police etc

R. E. Waterston discusses treatment of fractures of the extremities At the filter unit patients with fractured extremities are selected by the responsible doctor labeled according to injury and passed to the team of orderlies who apply the plaster in the form of slabs or gutters The plaster is applied in the long axis of the limb and fixed by an open weave cotton bandage which is cut when the plaster has set An essential feature is that in no instance is a limb actually encircled by plaster The chief advantage of plaster over other splints is that it molds to the contour of the body and can therefore, be applied directly to the body surface without risk of pressure. A slab may be applied over a silk stocking a shirt sleeve or a sock but not over a trouser leg jacket sleeve or shoe.

In the treatment of mass burns casualties R. S Hunt observes that the care of the burned surface is of secondary importance and should be deferred until the patient s general state has been stabilized by adequate fluid replacement Blood will be virtually unobtainable and plasma expanders will have to be used instead Many of the usual sites for intravenous infusions may be burned and cut downs will be needed to introduce plastic tubes To avoid repeated operations and to encourage the drip to run longer 10 cc of 1% procaine solution may be placed in the infusion bottle The burned surface will have to be treated by the exposure method Obviously there are exceptions for which the dressings available should be reserved e g if a patient were burned back and front one surface would have to rely on dressings Sorting casualties should depend on the grade of the burns skin thickness and age of the patient. No patient should be denied treatment simply because he has been exposed to radiation

► [The possibility of an attack by an enemy nation with atomic and hydrogen bombs has greatly increased the problem of planning for the care of mass casualties of civilians. The initial problems posed by a mass casualty are the selection of patients who are to be definitively treated and determination of the order in which they are to receive care. Most physicians and surgeons are inclined to postpone a study of the role which they would be expected to play, in the event of such a tragic situation as that discussed by Sir Alexander Drummond. A majority of the civilian population is unprepared for the work which it should be ready to perform in the event of such mass casualties. This excellent contribution, with additional comments about the care of fractures of the extremities by Lieutenant-Colonel

R E Waterston and the treatment of mass burn casualties by Lieutenant Colonel R S Hunt, should be read and reread by every physician and surgeon in the free world. Abstracts of selected materials of this type should be taught to medical students student nurses and practical nurses The civilian public should be aroused by presenting the facts through newspapers magazines radio television and motion pictures.—Ed.]

Physiatric Aspects of Care of Severely Injured Patient are considered by Frederic J Kottke[9] (Univ of Minnesota) Whenever a patient is severely and acutely disabled by trauma or disease the first concern should be for treatment to maintain vital bodily functions correct any trauma or combat the acute disease. Shock or hemorrhage must be treated without delay and infection prevented or treated adequately Fractures must be reduced and immobilized. During the acute emergency the need for intensive therapy to support and restore the patient may lead to neglect of planning for eventual recovery When the patient is critically ill for days or weeks neglect to establish a program of total patient care may result in deterioration of his condition Rehabilitation is concerned with restoration of the disabled patient to maximal independence Prevention of deterioration during acute disability is important in securing recovery and should be a part of the program of care

Prolonged inactivity during confinement to bed may result in permanent disability The basis of the development of functional ability by any organ of the body is use Within physiologic limits each part of the body increases in functional ability in proportion to the load placed on it. Conversely inactivity or nonuse results in regression of the part with loss of ability to function.

The common types of deterioration in patients confined to bed are loss of mobility loss of muscular strength and endurance, circulatory deterioration ischemic ulcers and metabolic imbalances

Clinical experience has shown that fibrosis due to loss of mobility is particularly difficult to treat when it occurs around certain joints In joints not easily moved through the full range of motion in bed progressive limitation of motion develops This is particularly true of the hip which is kept in partial flexion whether the patient is lying on a soft bed semireclining or sitting Pillows under the knees increase the flexion in the hip and maintain flexion in the knee.

(9) J A M A 165 1930 1935 Dec 14 1957

The hip and knee must extend fully if a patient is to stand easily without great muscular effort Some joints are difficult to stretch effectively It is not easy to immobilize the short, broad heavily padded pelvis so that the hip flexors can be adequately stretched Effective stretching of the triceps surae is difficult because it is such a powerful muscle group

A bed which provides adequate support in the proper position to minimize contractures is usually referred to as an orthopedic bed Its essential features are a bedboard to provide a flat foundation beneath a firm mattress and a foot board A bed with an ordinary mattress on an ordinary spring allows sagging of the hips of 2 5 in The hip flexion which occurs with the patient supine in such a bed may not be apparent on casual inspection However if the patient is bedfast, so that the hips are not extended beyond this position, contractures develop and produce a flexion deformity Sitting during the day does not oppose this shortening of the flexor fascia. To provide a firm foundation for the mattress a ¾ in bedboard is substituted for the bedspring On this is placed a firm felt or innerspring mattress Such a bed decreases the flexion of the hips and rounding of the back and shoulders which occur in a sagging bed

When joints may not be moved because of fractures any motion must be confined to the soft tissues In these patients maintenance of flexibility of soft tissues is especially important. Trauma has caused extravasation of blood into tissue planes. Fibrin has precipitated in the extravascular spaces and has formed networks on which collagen can be laid down Edema decreases both flexibility of the tissues and nutrition of the cells All these factors tend to produce dense scarring As a result joint motion may be lost, though no trauma has occurred to the joint surfaces. Heat stimulates increased circulation and increased healing Massage is useful in these patients to aid venous and lymphatic return reduce edema and maintain flexibility in muscles and periarticular soft tissues. Dense scarring is decreased by daily massage during immobilization, and greater range of motion is present when bony union has occurred Electric stimulation to cause muscle contraction or voluntary muscle-setting exercises are valuable to maintain flexibility and strength of the muscles

The patient who must remain in bed for a prolonged period should be given exercises to do A few strong contractions of a muscle each day are adequate to maintain its size and strength Pulleys or other exercise apparatus attached to the Balkan frame allow the bedfast patient to exercise muscles of the uninvolved extremities

A common type of deterioration in bedridden patients is the development of decubitus or ischemic ulcers These form over bony prominences or areas where pressure is great enough to interfere with capillary circulation Since decubiti are the result of ischemia the best method of treatment is stimulation of circulation The decubitus should be relieved from all pressure Wet or greasy dressings which macerate the skin should be avoided Radiant heat from a light bulb or heat lamp increases circulation and aids healing

Energy Expenditure in Assisted Ambulation. Early mobilization and ambulation after open reduction and internal fixation of fractures of the femur have become generally accepted as the treatment of choice in elderly people. Ambulation is usually managed on an empiric basis with no data available as a guide in determining the type or degree of assisted ambulation for specific cases

Lee J Cordrey Amasa B Ford and Miguel T Ferrer[1] (Cleveland) studied 20 patients aged 50-87 with fractures of the upper femur to determine the energy expended in ambulation with external support the type of assisted ambulation producing the least energy expenditure effects of assisted ambulation on the cardiovascular system and optimal duration of exercise periods All patients had a variable period of training before testing

The average energy cost of assisted ambulation was 2 82 calories/minute about 30% of the maximum energy expenditure for healthy persons of the same age This may approach the actual maximum for certain patients No significant differences in energy expenditure were demonstrated in patients using crutches walkers or parallel bars Some patients showed marked increases in pulse rate and blood pressure during 3 minutes of assisted ambulation. It is suggested that pulse rate may be used as a guide to optimal duration of exercise in a specific case

► [Orthopedic surgeons and other clinicians are, for the most part, totally

(1) J Chronic Dis. 228-233 March, 1958.

unaware of the energy costs of assisted ambulation of their patients. The effect of exercise which to a normal healthy person would be negligible, may include for the elderly convalescent patient a significant increase of pulse rate or blood pressure.—Ed.]

Use and Abuse of Ambulation Training in Rehabilitation is discussed by Arthur S. Abramson[2] (Yeshiva Univ., New York). Excessive ambulation may be damaging in advanced stages of osteoarthritis of the hip when weight bearing areas become small; this is especially true in obese persons. At this stage surgical treatment or ambulation with an ischial weight bearing brace may be attempted. In all stages, but especially in the more advanced, excessive stress on joints due to obesity should be minimized by weight reduction.

The quadriceps muscle usually atrophies rapidly after synovitis of the knee, whether latter is due to direct trauma or a result of surgery. Atrophy occurs also in other disabilities of the knee, such as those associated with rheumatoid arthritis.

Powerful, well trained surrounding muscles can preserve the stability of a knee joint in which the ligaments are badly damaged. A damaged knee can be stabilized to prevent regression of synovitis by training the quadriceps to a strength of two thirds that of the other, normal leg.

It is good practice to persist in walking to the limits of residual pain after analgesia and in the absence of marked constitutional illness. Walking with unsupported and unbraced joints in advanced stages of joint destruction is unquestionably damaging. Any walking may be damaging in the absence of preparatory exercise to stabilize joints by strengthening muscles.

Early treatment including bandaging of the stump, exercising muscles and stretching the joints may help to prevent certain complications of amputation. Even more effective is early pylon ambulation begun as soon as a wound heals and sutures are removed. Pylons are easily fabricated with stockinet, felt, plaster of paris and walking irons. Such measures seem to eliminate phantom pain entirely and to reduce stump pain considerably.

In hemiplegia early ambulation usually gives better functional result. Delay in starting rehabilitation of hemiplegic patients may permit the development of unmanageable spasticity. Long periods of bed rest and inactivity in a wheel

(2) Postgrad. Med. 23:178-185, February, 1958.

chair may result in flexion and external rotation contractures in the affected lower extremity Although passive and active exercises can effectively prevent these complications and stimulate return of function weight bearing and ambulation are far better stimuli

To walk safely a hemiplegic patient with residual paresis may require a short leg brace or drop-foot brace. Neglected hemiplegic patients whose training has started late and who have severe spasticity and flexion contractures of varying degree may need a long leg brace permanently Even with this aid functional result may be relatively poor

A brace can interfere with the natural rhythm of the newly integrated gait and occasionally with stability If the foot clears the ground without tripping either with or without an elevation on the opposite shoe, and if the foot can be placed flat on the ground a brace is not indicated, even when there is equinovarus deformity

Ambulation training is useful in paraplegia if it is judiciously combined with wheel-chair locomotion. In most cases attempts to develop complete ambulation are an abuse of this form of training

► [With the development of new centers for rehabilitation in all sections of the United States and in Europe, it is timely for an expert in this field to cite the dangers of enforced ambulation for patients with certain types of arthritis, myocardial insufficiency or extensive vascular disease. A careful evaluation of the entire patient should be made before beginning any rehabilitation program. The activities required or permitted should be graded according to the determined physical capacity —Ed.]

Role of Surgeon in Rehabilitation is discussed by Ross T McIntire[3] (Chicago) Surgical rehabilitation concerns both traumatic and reconstructive surgery together with corrective therapy of the physically handicapped. In fractures of the vertebrae, the most important problem confronting the surgeon is the advisability of decompressing the spinal cord. Operations for stabilization must be done much later Early treatment of fractures of the cervical spine has long been argued by orthopedic surgeons and neurosurgeons. Often the difference between complete recovery and invalidism rests on their decision

Severe disfiguring injuries to the face demand combined skill to recreate a presentable appearance and to obtain good function of the nose and air spaces In severe injury the orbit presents one of the most difficult problems In certain dis

(3) J Internat. Coll. S[illegible] 28 612-617 November 1957

cases, exterior damage to the eye lids and surrounding skin requires reconstructive surgery.

Congenital defects, especially those of the hands, need the teamwork of plastic surgeon and "hand surgeon" for satisfactory correction.

Orthopedic surgery has advanced rapidly in the corrective treatment of postpoliomyelitic patients. Accurate knowledge of anatomy and neurology has aided particularly in transplanting of muscle tendons as well as in providing new nerve supplies to paralyzed areas. Reconstructive operations for paraplegia have resulted in restoring many who formerly would have been permanent invalids to a mobile, productive life.

As a result of new knowledge of nerve supplies, the use of sympathectomy, understanding of how to handle a spastic bladder, and sound measures of corrective therapy, many paraplegic patients have become self supporting and able to care for their own body needs. But regardless of how well a paraplegic may be adjusted, he requires constant watching by the surgeon to help prevent degeneration in the kidneys as well as in the other genitourinary structures.

Almost any operation can be classified as reconstructive. In most instances additional treatment is needed. Physical therapy with restraint in using injured or paralyzed members should be intelligently conducted and may be required for a long period. Every surgeon has a serious responsibility in the field of rehabilitation, especially with respect to the nervous and mental aspects of the problem of physically handicapped patients.

► [The interest which Ross T McInture manifested during World War II in promoting development and use of rehabilitation facilities in the United States is known to all informed surgeons. The importance of teamwork among the various specialists to obtain the best possible results is emphasized in this excellent presentation.—Ed.]

Problems in Claims Handling of Injury Cases are discussed by W Scott Allan[4] (Liberty Mutual Ins Co, Boston). In both workmen's compensation and general liability insurance the greatest controversy seems to revolve around the evaluation of disability. Such evaluation may be called for in written reports or in testimony before trial courts or industrial commissions administering the workmen's compensation act. Admittedly, it is not easy to devise methods

(4) Pennsylvania M J 61 341 347 March, 1958.

Biologic Effects of Ultrasound are discussed by Edward J Baldes J F Herrick and Charles F Stroebel[5] (Mayo Clinic and Found) The primary effects of ultrasound are usually regarded as (1) thermal due to absorption of sound energy in the form of heat (2) mechanical resulting from (a) cavitation in which vaporous bubbles or cavities appear and from (b) deformation of the propagation mediums, and (3) chemical involving formation of oxidation products the mechanism of which seems also dependent on cavitation

Secondary considerations are also important to understand better the biologic reaction mechanism Structural heating occurs at abrupt interfaces in tissues of different acoustical impedances Mechanical forces of considerable magnitude may occur in a tissue during ultrasonic irradiation Elementary particles in the propagating mediums may be accelerated to more than 100 000 times the force of gravity by a sound intensity of 5 watts/sq cm at 800 000 c

The frequency relationships of ultrasound may be used to achieve a specific effect since the likelihood of cavitation is greater at lower frequencies and the likelihood of sound absorption at interfaces involving the thermal effect is more pronounced at higher frequencies

The biologic reaction in the bovine lens to focused ultrasound of a frequency of 175 000 c (1 4-cm focus) at 36 watts/sq cm is reversible bubble formation within the lens Under a hydrostatic pressure of 3 atmospheres the bubbles do not form

The chief biologic reactions of nerve to ultrasound are paralysis blocking and a decrease in action potential There is some disagreement as to the primary effects of ultrasound responsible for these reactions

The chief biologic reaction of bone to ultrasound of moderate intensity (2 5 watts/sq cm.) is thermal resulting from great disparity of impedance between muscle and bone. At abrupt interfaces of this type absorption of sound energy is very great. This is due in part to the high coefficient of absorption by bone in part to conversion of the longitudinal sound wave into transverse components which may travel as highly damped shear waves at right angles to the line of propagation of the original longitudinal wave and also to scattering consequent to multiple reflections The structural

(5) Am. J Phys. Med. 37 111 121 June, 1958

Manufacturers should include a warning of possible intoxication from overdose on labels of vitamin A preparations

Fat Embolism Studied in 100 Patients Dying after Injury H E. Emson[7] (Birmingham, England) studied the clinical records autopsy findings and histologic preparations stained for fat in 100 patients who died after injury and in 53 who died of burns or causes other than injury Pulmonary fat embolism was assessed quantitatively by counting emboli in a unit area of standard section and was classed as mild moderate or severe. In all patients of the trauma series and in some of the controls examination was made for systemic fat embolism in the kidney brain or both.

In the control series 40% showed pulmonary fat embolism though in all but a few it was minimal and insignificant. No control had systemic fat embolism or any symptoms suspicious of systemic embolism Pulmonary fat embolism was found in 89% of the patients who died after injury In the other 11% average survival after injury was 40 days and the shortest 12 days Systemic fat embolism was found in 24% of the patients who died after injury In 11% it was considered insignificant, in 6% of doubtful significance in 4% a contributory cause of death and in 3% the chief cause of death In no case was systemic fat embolism found in the absence of pulmonary fat embolism Pulmonary fat embolism increased in severity with the degree of trauma Systemic fat embolism was commonly found only in patients with severe pulmonary fat embolism.

The existence of a syndrome or of characteristic gross autopsy appearances due to severe pulmonary fat embolism was not confirmed Pulmonary fat embolism is not thought to be important as a cause of illness or death. Cerebral fat embolism is more important as a cause of symptoms and death than is commonly realized but it does not always give rise to a characteristic syndrome

Electric Burns of Upper Extremities are discussed by G Kenneth Lewis[8] (Chicago) A primary characteristic of electric burns is their tendency to progress beyond the visible changes noted immediately after an accident. Appearance, markings progression and other characteristics of electric burns differ in many ways from thermal injuries Apparently

(7) J Clin. Path. 11 28-35 January 1958.
(8) J Bone & Joint Surg 40-A 27-40 January 1958.

Burns resulting from lightning manifest diverse effects The extremely sudden discharge of current produces a flash and the resulting lesions may take the form of superficial or deep charring of the skin extensive full thickness skin loss and frequently punctate usually multiple areas of full thickness skin loss

The most important emergency medical treatment in electric injuries consists in artificial respiration cardiac massage if applied within 5 minutes of the accident and cardiac stimulants. Baldridge also suggests using intra arterial or intra cardiac injections of potassium and calcium salts In some instances prophylactic tetanus and gas antitoxin may be indicated

A conservative therapeutic approach is important Since examinations do not permit accurate estimate of the extent of the injury even after days or weeks because damage to soft tissues and bone is progressive an injury that appears relatively simple may ultimately become catastrophic Further the difference in characteristics pathogenesis and pathology of electric burns compared to thermal injuries allows delay before attempted debridement and definitive care of electric burns without danger to the patient

Primary repair or amputation should be deferred until the progression of tissue damage, bone sequestration demarcation of dead tissue, deep necrosis separation of sloughs and tendency toward progressive thrombosis has been stabilized or has ceased Normal appearing granulations often persistently resist skin grafts until the latent period has passed

Nevertheless as quickly as the final extent of destruction is accurately ascertained it is important that definitive repair be instituted and accomplished Bones and tendons must not be exposed and left without cover unduly long

In definitive care of the hand and upper extremity burned by contact with electric current the entire necrotic area is ultimately excised and then covered with a graft of indicated tissues such as split or full thickness grafts or pedunculated flaps Skin flaps are used when tendons are exposed or joints are open It is desirable to use local flaps when feasible. However in deep and extensive burns the entire back or front of a hand may have to be resurfaced with an abdominal flap

► [Most orthopedic surgeons have had few occasions to undertake the

emergency management of electric burns or to render definitive care to extremities extensively damaged as a result of electric injuries. Electricity is becoming increasingly important in industry and in all phases of civilian life. Exposure to the hazards of electric burns increases daily Every physician should know how to render emergency first aid, and all surgeons who are concerned with the rehabilitation of severely injured patients should be informed about the special problems which are created by severe electric burns.—Ed.]

Familial Form of Arthrogryposis in a boy 16 and his mother 38 is reported by R. Dailly and M Samson.[9] Both patients had limited motion in certain joints and muscular dystrophy the cardinal signs of this congenital anomaly In the son articular difficulty was the major complaint (angulation of the elbows lumbar hyperlordosis and clubfoot) whereas muscular dystrophy was moderate In the mother the major signs were dystrophy



Fig. 206.—Forced extension of elbow checked by myotrophic and retracted biceps. (Courtesy of Dailly R., and Samson, M.: Rev neurol. 98 320-328 April, 1958.)

and muscular deficiency of the pseudomyopathic type, principally at the roots of the extremities Such localized amyotrophy tends toward fibrosis and is not accompanied by fibrillations Tendon reflexes were absent in the upper extremities and markedly decreased in the lower limbs Idiomuscular reflexes were absent in the arms and thighs but were present in the forearm and calf. Pseudomyopathic characteristics common to both parents were more apparent in the mother whose joint limitation was slight Electric stimulation electromyographic and ra ologic examinations and biopsy did not permit any conclu jon as to neurogenic or myogenic origin although clinical indings favored the latter

In the boy s foot peroneal paresis resulted in a varus deformity of the tep and collapse of the plantar arch, as in poliomyelitis otrophy pronounced in the upper

(9) Rev neu April,

arm especially on the right where the biceps appeared contracted and fibrotic (Fig 206) Muscle tone of the fetus and its molding in the uterine cavity are considered responsible for these findings

This is believed to be the first report of arthrogryposis in successive generations of the same family In both patients the anomalies were recognized at birth and have not progressed

Hereditary Osteo-onychodysplasia Contribution to Ectomesodermal Dysplasia According to R. Kyselka[1] (Med Academy Erfurt, Germany) osteo-onychodysplasia is characterized by the following changes in the pelvic girdle by hypoplasia of the ilium low sacrum slight protrusio acetabuli and coxa valga in the knee by hyperplasia of the internal and hypoplasia of the external condyle with analogous changes in the tibia in the nails by dysplasia most commonly in the thumb nail, in the choroid by anomalies in pigmentation and in the elbow by hyperplasia of the epicondylus ulnaris humeri and hypoplasia of the distal head of the humerus and proximal head of the radius with dislocation of the latter Besides these characteristics, which are predominantly bilateral and symmetrical other anomalies have also been described These may occur as solitary abnormalities such as severe lumbar lordosis scoliosis spina bifida funnel chest and hyperplasia of the internal lamina of the skull

Deviations from these symptoms as well as abortive forms may occur in any generation Furthermore within one family the characteristic signs need not have the same localization In one member the changes may be more pronounced in the elbow whereas another may show conspicuous alterations in the knee.

The author studied a family with osteo-onychodysplasia. In one generation the characteristics of the disease were found to be unequally represented by various members Dysplastic knee changes dominated the syndrome in all members of the family though changes were not equally pronounced in each. In two members there was a bilateral lateral dislocation of the hypoplastic patella. Nail dysplasia, present in all members involved all the fingers in one generation whereas in the next generation there was bilateral involvement only of the thumb and 2d finger The elbow joints

(1) Arch. orthop. u. Unfall Chir 50:235-241 1958.

emergency management of electric burns or to render definitive care to extremities extensively damaged as a result of electric injuries. Electricity is becoming increasingly important in industry and in all phases of civilian life. Exposure to the hazards of electric burns increases daily. Every physician should know how to render emergency first aid, and all surgeons who are concerned with the rehabilitation of severely injured patients should be informed about the special problems which are created by severe electric burns.—Ed.]

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arm especially on the right where the biceps appeared contracted and fibrotic (Fig 206) Muscle tone of the fetus and its molding in the uterine cavity are considered responsible for these findings

This is believed to be the first report of arthrogryposis in successive generations of the same family In both patients the anomalies were recognized at birth and have not progressed

Hereditary Osteo-onychodysplasia Contribution to Ecto-mesodermal Dysplasia According to R. Kyselka[1] (Med Academy Erfurt Germany) osteo-onychodysplasia is characterized by the following changes in the pelvic girdle by hypoplasia of the ilium low sacrum slight protrusio acetabuli and coxa valga in the knee by hyperplasia of the internal and hypoplasia of the external condyle with analogous changes in the tibia in the nails by dysplasia most commonly in the thumb nail, in the choroid by anomalies in pigmentation and in the elbow by hyperplasia of the epicondylus ulnaris humeri and hypoplasia of the distal head of the humerus and proximal head of the radius with dislocation of the latter Besides these characteristics which are predominantly bilateral and symmetrical other anomalies have also been described These may occur as solitary abnormalities such as severe lumbar lordosis scoliosis spina bifida funnel chest and hyperplasia of the internal lamina of the skull

Deviations from these symptoms as well as abortive forms may occur in any generation Furthermore within one family the characteristic signs need not have the same localization In one member the changes may be more pronounced in the elbow whereas another may show conspicuous alterations in the knee.

The author studied a family with osteo-onychodysplasia In one generation the characteristics of the disease were found to be unequally represented by various members Dysplastic knee changes dominated the syndrome in all members of the family though changes were not equally pronounced in each. In two members there was a bilateral lateral dislocation of the hypoplastic patella Nail dysplasia, present in all members involved all the fingers in one generation whereas in the next generation there was bilateral involvement only of the thumb and 2d finger The elbow joints

(1) Arch. orthop. u. Unfall Chir 50 235-241 1958.

showed dysplastic changes with definite curtailment of extension and supination both clinically and by x rays. All persons showed hyperextension of the finger joints, due to *generalized connective tissue weakness.*

Treatment is required mainly for disturbed joint function, especially of the knee.

Isolated Bone Lesions Associated with Elliptic Erythrocytes were observed by Roy N Barnett and David S Brown[2] (Norwalk Conn Hosp) In several types of severe anemias such as sickle cell and thalassemia major the excessive marrow activity is associated with skeletal abnormalities demonstrable by x rays These lesions include generalized increase of bone trabeculae, osteosclerosis and irregular areas of bone condensation and rarefaction Bone lesions are usually *absent in mild anemias.*

The isolated bone lesions found in a mother and 2 daughters, were symptomatic in 2 instances The family also presented slight anemia and peculiar erythrocytes including many elliptical forms. The Italian ancestry and Cooley's anemia in a nephew of the mother suggest that thalassemia minor might account for the red *cell abnormalities* Target cells anisocytosis poikilocytosis and microcytes all are present in some members of the family Against this presumption are the lack of compensatory polycythemia in any member of the family and the lack of hemoglobin F in the patients whose blood was studied for this substance.

Whether the bone lesions were associated hereditary abnormalities or due to the blood dyscrasia could not be ascertained

Leukemia, Amyloidosis and Renal Vein Thrombosis in Irradiated Ankylosing Spondylitis were observed by John B Penfold and R D S Rhys Lewis[3] (Colchester England)

Man, 32 was discharged from the Army in 1945 with a diagnosis of ankylosing spondylitis. During 1945-48 he received about 1,200 r in deep x rays to the spine. He was subsequently encased in a spinal jacket, which he wore 9 months. During 1948-50 he received another 1 000-1,500 r in deep x rays to the spine. In 1953 he had left and right renal colic, and renal function was found to be poor Symptoms and signs of kidney failure slowly developed, and he died after several hemorrhagic episodes. Autopsy revealed ankylosing spondylitis, renal vein thrombosis, severe amyloidosis in the liver spleen and adrenals and lymphatic leukemia.

(2) J Mt Sinai Hosp., New York 24 706-712, Nov Dec., 1957
(3) Brit. M J 2 1034-1036, Nov 2, 1957

Amyloidosis occasionally occurs in ankylosing spondylitis, and there is evidence that renal vein thrombosis may occur in amyloid disease The patient s clinical chronic nephritis would appear to have been due to amyloidosis and renal vein thrombosis What part, if any, the irradiation played in production of the thrombosis is difficult to assess The dose of x rays was not excessive. It did not exceed 500 r at the medial surface of the kidney and 100 r at the renal parenchyma during 3 years. Further, vascular damage caused by irradiation is arterial and is an endarteritis obliterans the veins remain clear In this patient thrombosis sclerosis and calcification occurred in the veins, the arteries were apparently spared Thus it is more likely the renal vein lesions followed the amyloidosis. The possibility that leukemia followed the irradiation is undeniable.

Maffucci s Syndrome Dyschondroplasia with Hemangiomatosis, Report of Case The association of dyschondroplasia (Ollier s disease) with hemangiomatosis first described by Maffucci was observed by S L. Beranbaum and G Tzamouranis[4] (New York Univ -Bellevue Med. Center) in the following case.

Man, 44 had a soft tissue tumor in the left palm for 13 years At 16, he had a deep laceration of the palm which was sutured. A small tumor appeared 15 years later increased over the years and was accompanied by progressive enlargement of the distal phalanx of the left thumb. One year before hospitalization, he fractured the distal phalanx of the left ring finger Since then it had become swollen and deformed.

A soft-tissue mass was observed which involved the left hypothenar and thenar eminences and part of the lower wrist. The mass was multilobulated and measured over 3 in. Enlarged, racemose plexuses were visible under the skin. The skin moved freely over the mass and there was no involvement of the tendons. The distal phalanx of left ring finger was deformed and the distal phalanx of index finger was enlarged and thickened.

X rays (Fig 207) revealed a large soft tissue mass on the palmar aspect of the metacarpal region, measuring roughly 7×5 cm. Within this mass were small phleboliths indicative of angioma. An enchondroma was present in the proximal phalanx of the index finger with expansion of the distal two thirds of the phalanx with irregular trabeculation and calcification. Another small chondroma was present in the terminal phalanx of the 4th finger of the same hand.

The soft tissue mass measuring 8×7×3.5 cm., was excised. It appeared coarsely lobulated and covered by a layer of fibrous tissue.

(4) Am. J Roentgenol. 80 479-481 September 1958.

The pathologic finding was capillary hemangioma with fibrosis and chronic inflammation.

Dyschondroplasia affects the growing ends of bone and normal ossification does not take place As the bone increases in length areas of cartilage which fail to ossify persist in the metaphyses Dwarfing of the affected limbs with deformity

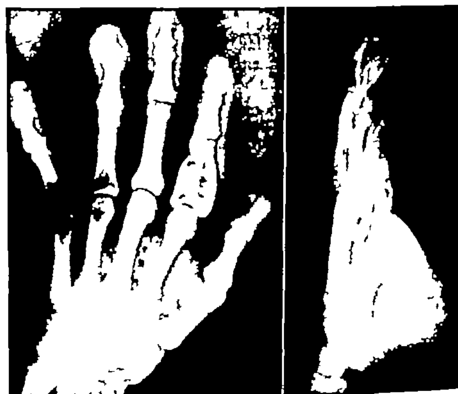


Fig 207 (Courtesy of Bernnbaum, S L., and Tramonranis, G. Am. J Roentgenol. 80 479-481 September 1958)

occurs It is often unilateral and markedly asymmetrical Most affected are the long bones including those of the hands and feet In the phalanges multiple enchondromas are noted.

Previous reports have shown an age distribution of 8-58 years The changes usually become clinically evident at or before puberty Deformity is stationary after full growth Amputation was necessary in half the patients reported Chondrosarcoma was seen in 4

Phenylbutazone Toxicity Depression of Erythropoiesis. Oscar Swineford Jr J C Curry and J W Cumbia[5] (Univ of Virginia) report a case

(5) Arthritis & Rheumat. 1 174-177 April, 1958.

Woman, 54 received phenylbutazone in daily doses of 200 mg or more for rheumatoid arthritis After treatment with the drug for about a year, a routine blood count revealed 3,400 000 red cells and 8.5 Gm. hemoglobin. The white cell count was 4,500 (about the level it had been before therapy) and the differential count was normal The patient was hospitalized and phenylbutazone discontinued. Four days later the red cell count was 2,600 000 hemoglobin 9 Gm. and hematocrit 22 vol. % and the leukocyte and differential counts were normal. There were no reticulocytes Sternal marrow showed complete absence of erythropoietic activity but the myeloid series was orderly The direct Coombs test was positive. The patient had no symptoms. A good response was observed to therapy with prednisone, 40 mg daily in divided doses, given for 2 weeks. Tests revealed a further decrease in red cells and hemoglobin, and prednisone was discontinued for 2 weeks. A prompt and sustained erythropoietic response followed a second course of prednisone.

This is the first report of marked depression of erythropoiesis by phenylbutazone Other formed elements of the blood were not significantly affected. Regular examination of the blood of patients receiving this drug will prevent such complications.

► [Phenylbutazone is the most effective nonnarcotic pharmaceutical for the relief of pain caused by osteoarthritis It has proved to be very useful in the treatment of all the rheumatic diseases, including gout. Severe toxic reactions, in almost every reported instance, have resulted from administration of 600 mg. or more of phenylbutazone daily for short periods or continuous medication with smaller amounts (300 mg. or less) for many weeks or months. In the case reported 200 mg or more was ingested daily for more than 10 months. Even when smaller doses are used, the medication should be discontinued intermittently for about 2 weeks to permit the hemopoietic system to recover from what may be subclinical toxic effects. —Ed.]

Painful Nonsuppurative Swelling of Costochondral Cartilages (Tietze s Syndrome) was studied by Everett H Karon Richard W P Achor and Joseph M Janes[4] in 7 males and 6 females aged 11-79 The commonest presenting symptom of this syndrome is anterior thoracic pain, though rarely swelling of a costosternal juncture may appear first. Pain is usually localized to the site of the affected cartilage, but it often spreads laterally and may involve the neck shoulders or arms. Onset may be gradual or abrupt with wide variation in severity and character Inclement weather anxiety fatigue and recumbency may intensify the pain. It may be aggravated by coughing sneezing deep breathing or activity and it may simulate pleuritic pain Discomfort lasts a few

(4) Proc. Staff Meet. Mayo Clin. 33 45-53 Feb 5 1958.

days to several months though gradual subsidence over a few weeks is most frequent. Exacerbations are common and attacks may recur after several years of quiescence, as happened in 1 of the authors' patients Systemic symptoms are noticeably absent

The presence of a firm bulbous or fusiform swelling of one or more of the costosternal cartilages is essential for diagnosis of Tietze s syndrome Tenderness is generally present though it may not be noted initially and it is often one of the first findings to disappear Heat redness or signs of suppuration are characteristically absent, and the overlying skin is freely movable and distinct from the mass The swelling rapidly reaches maximal size and then remains stationary or slowly regresses Complete spontaneous regression of the lesion rarely occurs before several months have elapsed. but eventual complete recovery is the rule No significant x ray abnormalities are present Gross findings at operation have been variable Swelling of the perichondrium and soft tissues has been described but is not a constant feature. The involved cartilage appears abnormally prominent

Treatment is nonspecific but infiltration of hydrocortisone or related steroids into the involved site may afford prompt relief for patients with persistent discomfort

Reversibility of Pregangrene in Severely Ischemic Limb is considered by A W Humphries V G Dewolfe and F A Lefevre[7] (Cleveland) with reference to two series of patients with varying degrees of ischemia. Development of sudden total occlusion of the main artery results in an essentially ischemic limb since collateral circulation does not have sufficient time to develop and take over the supply of blood to the lower extremity (Fig 208) However sudden occlusion accounts for a relatively small percentage of the total number of amputations of which the slow progressive arteriosclerotic process in older patients is the most common cause. Since the vascular lumen narrows gradually there is a need for collateral vessels and for time in which they can form Thus when occlusion of the artery is complete collateral circulation may have developed to such an extent that the only symptom is intermittent claudication This will ap-

(7) J Bone & Joint Surg 40-A 983-993 October 1958.

pear in the calf when occlusion is in the femoral artery, in the hip when it involves the iliac artery or in both hips or low back when it is in the aorta (Fig 209)

It was found impossible to determine by history or physical examination whether occlusion was segmental or nonsegmental This can only be demonstrated by arteriography



Fig 208.—Occlusion of aorta at level of 3d lumbar vertebra. Vessel descending through abdomen is inferior *mesenteric artery* (Courtesy of Humphries, A. W., *et al.* J Bone & Joint Surg 40 A 983 993 October 1958)

or direct surgical exploration If an arteriogram shows an adequate outflow grafting is done as a primary procedure If an obvious nonsegmental occlusion is shown sympathectomy usually is performed on the principle that it may lower the level of eventual amputation should it not succeed in saving the limb When an arteriogram is equivocal distal exploration in the lower portion of Hunter s canal or in the popliteal space is required The artery at the distal end of the occlusion is transected and outflow in the patent vessel below this point is evaluated by means of a pump that deliv

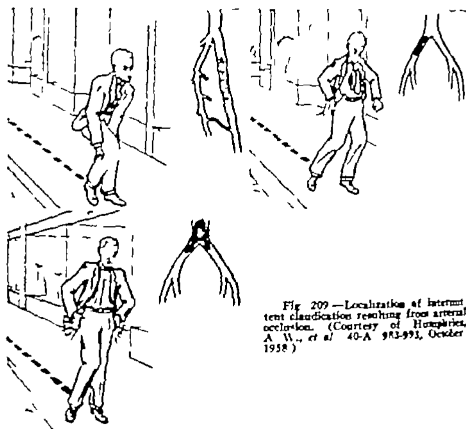


Fig 209 —Localization of intermittent claudication resulting from arterial occlusion. (Courtesy of Humphries, A W., *et al* 40-A 983-993, October 1958)

ers blood under measurable pressures and also measures flow of blood per impulse beat If the run-off is high a graft is indicated if it is low a sympathectomy is done.

Polyosteochondritis. Raymond Turpin and Florent Coste[8] (Paris) isolated polyosteochondritis from a complex group of metaepiphysial dysplasias in 1941 basing its specific entity on its familial character and characteristic radiologic, clinical and histologic findings

The disease consists of generalized and symmetrical osteochondritis evident at age 3-4 which continues throughout the growth period and involves the extremities more than the spine It is accompanied by muscular hypotony and laxity of the ligaments affects only endochondral ossification and gives histologic evidence of dystrophic ossification without inflammatory changes The process terminates with completion of growth. Affected persons are of small stature, but deformity is slight. The only functional disturbances result from defects in coaptation of articular surfaces and from an

(8) Ann. pédiat. 34 234-244 Jan. 24 1958.

gulations and their consequent anomalies There is no pain or ankylosis and mental development is normal Locomotion is difficult because of joint instability

X rays show enlargement of the ends of long bones Epiphyses have irregular contours and are flattened and reduced in thickness with irregular ossification Besides these features, several large centers exhibit an appearance of fragmentation different from that of punctate epiphysial dysplasia. Metaepiphysial regions are irregular and enlarged in contrast to the intact diaphysis The meshes of the spongiosa are enlarged

X-ray changes in polyosteochondritis show progressive improvement The centers of ossification which give the epiphyses a fragmented appearance are generally fused at adult age. Metaepiphysial closing is usually somewhat retarded but successive x rays show a tendency toward consolidation and elaboration of good bone tissue Nevertheless the disease leaves its mark in the form of secondary traumatic arthritis and angulations Articular damage sometimes causes the appearance of osteoporotic zones alternating with condensed areas. The spine is usually cupped with a tendency to kyphosis, and some vertebrae especially dorsal are flattened or even deformed The humeral head remains large and slightly deformed and deformity is seen in the elbows and coxofemoral joint. Articular damage appears also in the knees where genu valgum causes secondary osteoporosis The deviation sometimes justifies osteotomy of the distal portion of the femur

This malady resembles Morquio s syndrome in some respects but has numerous points of difference, particularly the predilection of the latter for the spine and its recessive, autosomic inheritance linked to the X chromosome In polyosteochondritis inheritance is dominant autosomic and monogenic.

Surgical Management of Friedreich s Ataxia Myer Makin[9] (Rothschild Hadassah Univ Hosp Jerusalem) performed orthopedic surgery on 51 patients aged 9-38 with Friedreich s ataxia. Lower limb surgery was performed on 49 patients involving 94 feet Spine fusion was undertaken in 2 patients to correct scoliosis and in 1 to prevent advanc-

(9) Ann. Roy Coll. Surgeons England 22 1 10 January 1958.

ing round back deformity Scoliosis when present, was usually mild and nonprogressive.

The basic procedure in treating foot deformity and muscle imbalance was triple arthrodesis, involving resection of the talocalcaneal talonavicular and calcaneocuboid joints, with correction of the deformity by adequate wedging of the resections

Triple arthrodesis was performed in 40 patients Tendon transplantation, usually undertaken 6-8 weeks after foot stabilization was done in 21 patients Anterior transposition of the posterior tibial tendon is the most logical procedure. By this means the main deforming factor causing cavovarus is removed and the muscle converted into an active dorsiflexor of the foot. The transplanted muscle is unlikely to become affected by the progress of the disease.

Before deciding to operate it is advisable to know at what rate the disease has progressed. The patient should be kept under observation for 1 or 2 years or his case history should be well known to the physician Patients in whom the neurologic disability has progressed rapidly are not suitable for operation The objectives of surgery in the abortive forms of the disease are to correct the deformity to facilitate normal or near normal gait and in the progressive type to provide a stable base to help retard the effects of progressive ataxia. After surgery the house-bound patient occasionally may be taught to stand and to walk again independently Locomotor ability a process learned by the central nervous system may be lost through disuse particularly if the degenerative process produces inco-ordinate movement A patient who has lost the faculty for independent locomotion due to ataxia muscular hypotonia foot deformity or paralysis finds the relearning process prolonged and difficult even after the condition has been corrected After surgery the patient should be mobilized as soon as possible.

No deaths resulted from surgery in the 51 patients None showed unusually rapid progression of the neurologic disorder after operation The idea that surgery exacerbates the rate of progression was not borne out

Where complete correction of foot deformity was not achieved the cause was traceable to errors in surgical technic Of the 3[illegible] patients followed up an average of 7.2 years, 24 were able to lead useful lives with full functional activ

ity Eight showed improvement after surgery but suffered moderate restriction of activities

► [Most orthopedic surgeons as well as all other specialists, have considered Friedreich's ataxia a condition which could not be helped by any surgical procedure. The results reported and demonstrated by Makin show clearly that in some cases correction of foot deformities in children may permit ambulation for many years and greatly postpone the time when the patient will be completely bedridden.—Ed.]

PLASTIC SURGERY

Edited by

NEAL OWENS M D

CONGENITAL ANOMALIES

Severe Protrusion of Mandible Surgical Correction.—John B Erich[1] developed a three stage operation for surgical correction of mandibular prognathism All stages can be performed with the patient under local anesthesia.

TECHNIC.—The first stage involves extraction of all the teeth in the two portions of bone that eventually are to be removed In addition two parallel cuts are made on each side of the mandible from the alveolar process down close to the mandibular canal The bone between these cuts corresponds in width to the bone segment to be resected. The bone intervening between these cuts is not removed during the first stage.

In about 3-4 weeks before the second stage is begun, intraoral appliances must be inserted and attached to the teeth for ultimate fixation of the bony fragments. Much of the success of any operation for correction of mandibular protrusion depends on the effectiveness of the appliances used for immobilization. Hooked arch bars with intermaxillary elastic bands provide the ideal method of immobilization.

At the second stage, an incision 4-5 cm. long is made in the submaxillary region about 2 cm below the lower border of the mandible to avoid injury to the marginal mandibular branch of the facial nerve. Through this incision the body of the mandible is exposed by blunt dissection. By use of periosteal elevators the periosteum is reflected away from the buccal and lingual surfaces and the upper edge of the bone to expose the full circumference of the lower jaw where the bone segment is to be removed. After reflection of the periosteum, the saw cuts previously made through the alveolar process are readily visible. The entire wound should not communicate with the oral cavity.

With an indelible pencil two parallel lines are drawn on the external surface of the mandible to connect with the saw cuts The distance between these two lines represents the width of the bone segment to be resected. A motor-driven circular saw is used to cut along each pencil line from the lower border of the mandible upward almost to the level of the mandibular canal. A chisel is placed between the upper extremities of these two lower saw cuts (lower part of the mandible) and, by firm tapping of the chisel with a mallet the inter

(1) Proc. Staff Meet. Mayo Clin. 33 331 336, June 11 1958

vening portion of bone is removed. The chisel is then placed between the upper saw cuts (made 1 month previously) in the jaw and the piece of bone between the two saw cuts is detached. After these two pieces of bone are removed, only a small amount of bone remains about the nerve and vessels. By careful use of small rongeurs, this bone remnant is gradually nibbled away and the nerve and blood vessels which are left intact are exposed. A curet is used to remove some of the cancellous bone surrounding the nerve and vessels in each segment. A cavity is thus created in which the exposed nerve and vessels can rest without injury when the anterior and posterior segments are brought into apposition.

A small hole is drilled in each fragment near the lower border of the mandible about 1 cm from the cut edge. If a tooth is present in the posterior fragment for fixation, placing heavy chromic catgut through these two holes is preferable to approximate and hold the fragments together. If there is no tooth, a piece of heavy tantalum wire is used.

The third stage, performed 2-3 days later, involves removal of the bone segment on the opposite side of the mandible. The technic is identical to that described in the second stage. As soon as this stage is completed, the elastic bands can be applied to the intraoral dental appliances that previously were attached to the teeth. By constant traction, these rubber bands tend to pull the lower teeth into satisfactory occlusion with the upper dental arch. The rubber bands can be left in place for 4-5 weeks for immobilization of the fragments of the lower jaw. After removal of all intraoral devices, the dental occlusion often can be greatly improved by grinding down cusps of teeth that interfere with good articulation.

Unilateral Cleft Lip Repair. Robert F. Hagerty[2] (Med. College of South Carolina) presents a modification of the Mirault cleft lip repair wherein the Cupid's bow on the cleft side of the midline is dropped to a normal position and the V-shaped defect so created is filled with a flap of the proper dimensions taken from the upper lateral side of the cleft. The incisions are limited to the cleft side of the midline to avoid shifting the Cupid's bow from the midpoint of the lip and distorting the remaining philtrum. By so introducing the remaining tissue into the lower third of the lip, a more normal pout is obtained, notching of the lip is prevented and tension on the suture line is reduced. The operation is not done until after age 3 months so as to reduce the margin of error in the apposition of tissues, to permit endotracheal anesthesia with safety and to take advantage of the ossification of the midfacial bones which give strength to the dental arch to resist the collapsing force of the repaired lip when accompanied by a cleft palate.

(2) Surg., Gynec. & Obst. 106:119-122, January, 1958.

Exact approximation of the vermilion cutaneous junction is a little more difficult with angled incisions giving rise to occasional small irregularities which can be readily corrected at a later date The medial incision created on the lateral side of the cleft which opens as a groove to receive the tongue allows the elements of the Cupid s bow to be restored to their normal inferior position Thus the lateral displacement which accompanies a more vertical incision is avoided and symmetry of the lip is obtained with greater certainty

► [While this method of repair may be considered a modification of one or two older operations it succeeds in enabling one to make a direct approach, done in a simple manner to accomplish results which frequently are better than those gained by some of the older methods It is a method reduced to simplest adjustments and one which is productive of excellent results. —Ed]

Repair of Penile Hypospadias John G Gaskins[3] (Kansas City Mo) presents a three-stage repair that (1) uses the complete preputial tissue for repair (2) corrects the chordee (3) provides a urethra of adequate caliber length and termination at the tip of the glans (4) does not require indwelling catheters or diversion of urine (5) provides a double barreled second stage that edema or erection does not jeopardize (6) constructs a continuous urethra which is then incorporated in the penis (7) affords correction during preschool age (8) requires only three short hospital stays and (9) results in normal penile appearance

TECHNIC—*Stage 1*—The chordee is corrected by the Nesbit buttonhole technic, transplanting the prepuce from the dorsal to the ventral surface of the penis. The buttonhole is placed well back on the dorsal surface so as to obtain as large a skin flap as possible. None of the transplanted prepuce is excised all is preserved as a large, bulky skin flap extending from the urethral meatus to the denuded portion of the glans

Stage 2—The dependent ventral foreskin is grasped at its most dependent or central portion and is spread and drawn forward In cisions are then made to outline the skin for reconstruction of the urethra. The incised edges of the skin urethra are sutured together with multiple interrupted 4-0 chromic catgut sutures on a nontraumatic needle. The lateral skin edges are mobilized and advanced to form the outside skin covering for the urethra The urine is not diverted and no indwelling catheters are used The ventral skin flap containing the continuous completely reconstructed urethra is thus separate from the penis so the postoperative edema or erections that may occur do not embarrass the blood supply or produce tension on the suture line

(3) Plast. & Reconstruct. Surgeon 20 141 146 August, 1957

Stage 3—Two technics may be used. The simplest is to resect all the skin on the dorsal surface of the urethral flap and on the adjacent ventral surface of the shaft of the penis and glans in the area on which the urethra is to be placed. The two structures are then sutured together with multiple interrupted 4-0 chromic catgut sutures. Although the result is satisfactory the urethral meatus tends to be ventrally placed and the lower edge retracts behind the upper edge of the meatus. In the second technic, all the skin on the external surface of the urethral skin flap is resected and a subcutaneous tunnel is dissected from the base of the urethral flap to the tip of the glans. The reconstructed urethra is drawn through the tunnel and out through the glans and a few sutures are used to close the small remaining skin defect on the ventral surface of the penis. The skin edges of the urethra are sutured to those of the glans to prevent meatal stenosis.

Surgical Correction of Common Congenital Anomalies of Neck. According to McCarthy DeMere[4] (Memphis Tenn.), during the 4th embryonic week 6 ridges known as branchial arches are seen in the region of the neck and pharynx 4 are visible whereas the 5th and 6th arches are overlapped. These ridges are separated by grooves called branchial clefts that appear on the head of the embryo in the ventrolateral region. The 1st branchial arch divides into a maxillary and mandibular process The maxillary portion gives rise to the upper lip cheek upper jaw palate and most of the external ear The mandibular portion gives rise to the lower lip lower jaw parts of the tongue malleus and incus. The 2d arch provides the posterior portion of the external ear soft tissues of the upper part of the neck, stapes and styloid process. The 3d arch forms the greater cornu of the hyoid bone part of the pharynx, common carotid artery 9th cranial nerve and part of the pharynx.

The thyroid gland develops as a midline structure, projecting downward from the pharynx between the 1st and 2d pharyngeal arches About the 7th week the gland starts migration downward between the 1st and 2d arches between the developing ends of the hyoid bone and down to a position anterior to the larynx, with a lobe on either side of the trachea As the gland descends a tube from the base of the tongue is pulled down after it and degenerates when the gland has reached its final resting place. If it remains open the condition known as thyroglossal duct cyst or sinus has developed

It should be kept in mind that an anomaly by definition is deviation from the common rule and that in nature vari

(4) J Int'nat C Il. Surgeons 30 186-191 August, 1958.

ation is invariable." Therefore even though an anomaly of the 1st cleft usually extends from a point in the upper part of the neck above the level of the hyoid bone and below the lower border of the mandible to an opening into the external auditory canal, a similar sinus can extend from the preauricular region and follow a spiral course around the external auditory canal before it joins this structure.

Although most thyroglossal duct cysts and sinuses are located in the midline, several have been found as much as 5 cm from the midline. In treatment of all such lesions, the cutaneous incision is always made to lie in the folds of the skin in the midline, the incision is always made transversely. In lesions of the thyroglossal duct, if the tract extends to the hyoid, it is more than likely that it extends all the way to the base of the tongue. A safe rule therefore is always to remove a section of the hyoid bone in the midline and to search carefully for a possible tract leading upward.

Role of Posterior Pharyngeal Flap in Rehabilitation of Patient with Cleft Palate. J. J. Longacre and G. A. deStefano[3] (Cincinnati) report a series of 52 patients on whom they performed a posterior pharyngeal flap procedure, with and without retropositioning of the palate for the following conditions: (1) paralysis of the palate (bulbar polio), (2) rhinolalia aperta due to submucous cleft with failure of fusion of the muscles, (3) congenital foreshortening of palate (apparent after adenoidectomy) and (4) scarred foreshortened palates following cleft palate repair. All patients had marked nasal escape with typical cleft palate speech. Most had had speech therapy with only moderate benefit, because they did not have the mechanism for production of adequate velopharyngeal closure. Once this was provided, speech improved markedly.

This group was followed 6½ years and a gradual change occurring in the old badly scarred cleft palates was noted. They became increasingly vascular because of new blood supply obtained from the pharyngeal flap. The firm beaverboard-like scar disappeared and the soft palate became more pliable and supple. Whether or not neurotization actually occurs has yet to be determined. In most patients sufficient palatal length was obtained by turning down a hinged flap from the nasal side of the soft palate and anchoring the pos

(3) Am. J. Surg. 94:882-888, December, 1957.

terior flap with its pedicle from above into the denuded area. Some required retropositioning of the entire palate as suggested by Conway. A few required extraoral tissue. All posterior pharyngeal flaps were made extremely wide and an attempt was made to epithelize all raw areas completely. As a result in only a few cases did the flap tube itself.

Surgical Treatment of Congenital Deformities of Ears. Varaztad H. Kazanjian[6] (Boston) observes that up to the present no standard procedure has been developed for reconstruction of the external ear. He limits his discussion to one type of congenital deformity, i.e., an ear with only part of the lobule present. The rest of the auricle is usually an underdeveloped shapeless mass of skin and cartilage with an absent ear canal. X-rays show that the external auditory canal is not developed, and usually the malleus and incus are fused. The inner ear, being of different developmental origin, is always normally developed.

Reconstruction consists of three general steps: most important is reconstruction of the concha; next soft tissue is transferred from adjacent or distant regions in the form of a tubed flap; and finally a framework is supplied to the ear. Surgery is postponed until the patient is at least age 3. The author is usually able to create a fairly normal looking ear before the child starts school. Most successful reconstructions have required five stages.

METHOD.—The concha is reconstructed through a vertical incision made just anterior to the microtic ear, thus creating a cavity the size of a normal concha. The floor and sides of this cavity are covered with a postaural skin flap raised from a nonhairy region, which is drawn through an incision which pierces the full thickness of the microtic ear. This postaural graft usually covers most of the cavity, and the rest of the cavity plus any uncovered areas of the rudimentary ear are surfaced with a full thickness skin graft from the normal side. A tube flap is formed in the left clavicular region and shifted up to the ear to supply needed skin and subcutaneous fat along the periphery of the ear. Meantime, the base of the postauricular flap is transferred to cover the lower wall and rim of the concha. For the framework the author uses concha cartilage from the opposite ear supplemented by costal cartilage if necessary.

(6) Am. J. Surg. 95: 185-188, February, 1958.

Present (1957) Outlook on Burns is evaluated by A B Wallace[7] (Edinburgh) Locally the burn wound can be classified as closed or open The superficial burn wound with the break in the skin surface is at first open the deep burn wound with complete cover of dead skin (eschar) is at first closed If the superficial burn area is exposed the plasma surface exudate clots and dries and the wound becomes closed with a pellicle dressing Within 3 weeks the scab separates leaving a delicate epithelial surface formed from cells lining hair follicles sweat and sebaceous glands The cover sequence in superficial burns is skin plasma pellicle skin Deep dermal burns are strictly speaking superficial burns but few viable epithelial elements remain separation of the pellicle and therefore healing is slow The cover sequence is skin pellicle skin

After burning considerable upsets occur in the body fluids and their functions In deep burns the predominant replacement is blood in superficial burns plasma Plasma or blood is given in all burns of over 10% in children and of over 15% in adults The volume given depends on the patient s age and extent of the burn In addition to replacement fluids requirement fluids are also given to make up for loss from the skin lung gut and kidneys and given daily by mouth without electrolytes e.g dextrose in water with orange juice Supportive therapy consists of pain relief oxygen administration and antibiotics

In local treatment the burn wound is kept dry and cool and the skin-to-skin cover sequence is followed

TECHNIC.—When shock is controlled the patient is taken to the theater and the burn surface and surrounding skin is cleansed with 1% cetrimide. Inhalation anesthetic may or may not be necessary Blisters are snipped and the overlying skin removed. Thereafter the burn wound is kept dry and cool by exposing the part or applying an absorptive dressing The aim in a superficial burn is to get a plasma pellicle and preserve it intact until the scab separates and healing is completed. In a deep burn the eschar is kept dry and if possible cool until excision and graft is carried out. Sterile large rolls of Gamgee tissue are most useful as an absorptive dressing Patterns can be cut and applied to any part of the body in a few minutes. All

(7) Plast. & Reconstruct. Surg. 21:243-251 April, 1958

burned surfaces should be kept cool, immobilized and if possible elevated

Some regions are best exposed, e.g., the face, genitalia, one aspect of the trunk. Other regions are best treated by absorptive dressings, e.g the hands scattered areas. Circumferential burns, e.g., the trunk, can be exposed on expendible absorptive pads (changed daily) or dressed, but no matter which method is adopted the patient is nursed on a turning frame bed and turned every 6 hours to allow the burn surface and dressings to dry The pellicle or eschar must always be dry and the dressings always absorptive. The skin to-skin cover sequence concept is followed and excision and grafting are carried out at the earliest moment. The actual time will depend on the patient's age available skin for grafting sites available for transfusion, experience of the team, etc.

It is important to make use of all available donor skin in the most economical sequence. This may entail removal of 20% surface area of the skin on the 5th day storing the skin, and then on the 14th day removing a second crop from the same area. Homografts might well be used to great advantage in the skin to-skin cover sequence skin, eschar homograft, autograft, skin. As nutrition, 1.5-4 Gm. protein/kg body weight and 45-60 calories/kg body weight are given daily

Prevention of Secondary Tissue Destruction in Burns. According to Robert J Meade[8] (Tulane Univ) in extensive deep burns immediate excision and grafting are hardly justified Blood loss and production of further wounds in obtaining the grafts are added insults to an already severely injured patient even if sufficient normal skin is available to cover the excised areas During the last war decompression procedures definitely minimized tissue destruction Wounds that were widely debrided often could be closed in a few days with relatively little manipulation of tissue. Fasciotomy saved many damaged extremities The effects of these procedures are principally circulatory

In 4 patients with severe deep burns decompression by incision of the eschar was carried out. This was done not for the direct effect on the burned area but for specific indications of circulatory or respiratory embarrassment as observed in a patient

Man, 43 was severely burned on the right hand while attempting to put out a fire in a chair When seen about 12 hours after the injury the skin of the dorsum of the hand and tips of the fingers appeared charred. Sensation distal to the wrist was absent. Incisions were made transversely through the eschar to relieve ischemia and possibly to preserve the extensor tendons in the fingers. Evidence of vascularity of the subcutaneous tissue was delayed for several minutes. Several days later there were areas of viable dermis (Fig 210)

(8) Plast. & Reconstruct. Surg. 21.263-271 April, 1958.

Eventually it was necessary to amputate the little finger and the distal phalanges of the other fingers were lost. However, a usable hand was salvaged and the extensor mechanism preserved. Radical incisions in the fingers in the midlateral region might have saved the tips.

These benefits are derived from decompression (1) improvement in local blood supply with conservation of subcutaneous fat and some dermis (2) drainage of burned area,

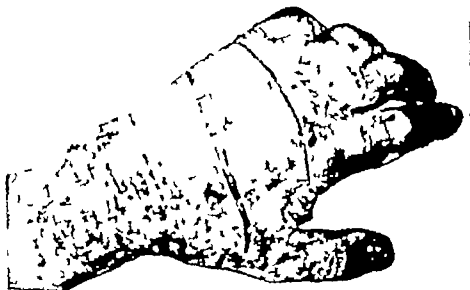


Fig. 210—Decompression incisions of hand. (Courtesy of Meade R. J: Plast. & Reconstruct. Surg. 21:263-271 April, 1958.)

removing fluid, metabolites and electrolytes (3) decompression of underlying structures, nerves muscles, tendons and blood vessels, thereby preventing ischemic changes, including nerve necrosis muscle necrosis and fibrosis tendon necrosis and gangrene of the extremities or parts of the extremities (4) reduction of chances of overloading with fluid with diminished likelihood of development of pulmonary edema and (5) possible relief from local and renal vasospasm through anoxic and pain reflex. The disadvantages are increased fluid loss possible hemorrhage, necessity for dressings, frequent change of dressings and delayed separation of the eschar

► [A most important fundamental in the management of burns, properly evaluated. It is amazing that this aspect of burns has not been discussed before. A full appreciation of the importance of the problem discussed will serve to save much tissue and avoid the troublesome complications which are frequently found in burned patients.—Ed.]

Practical Technics in Care of Burn Wound are discussed by Curtis P. Artz[9] (Univ. of Mississippi). The aim in treatment of 1st- and 2d-degree burns is to provide an environment of cleanliness so that the areas will heal free from infection. Local management of 3d-degree burns is early removal of dead tissue and closure of the wound as soon as possible with a skin graft.

Most 2d-degree burns are extremely painful and must be covered immediately, preferably with a clean cloth to protect them from the air. All burns should be cleansed, then blisters and detached epithelium should be removed. Masks should be worn by all in attendance. In the extensively burned patient fluid and electrolyte replacement should precede local care. A general anesthetic is contraindicated; intravenous morphine provides adequate analgesia.

In definitive local care the exposure method may be used if the burn is of such configuration that this is easy and adequate. The method is actually a closed one because the wound of a 2d-degree burn becomes covered with a crust which closes the wound to invasion by micro-organisms. In full thickness burns the dead tissue becomes dry and forms an eschar that serves as a protective covering for the wound. The covering must be constantly protected against cracks.

Occlusive dressings should be used in all burns in which the exposure method is not applicable. A dressing should be applied that will absorb the fluid and prevent invasion of bacteria. The dressing should be applied with even resilient compression so as to eliminate dead space, limit venous and lymph stasis and produce a splinting effect. Dry fine-mesh gauze, lightly impregnated petrolatum gauze or some commercial nylon preparations are satisfactory. Outside the initial layer there should be many layers of some absorptive material.

Immediate excision during the first 2-3 days is desirable since it permits removal of all dead tissue soon after injury. Its disadvantages are that within the first few hours or days it is difficult to determine accurately the extent of full thickness injury and surgical excision compounds the initial injury. In patients with burns not exceeding 15% of the body surface in whom there is definite evidence that the

(9) Am. Surgeon 24:593-599, August, 1958.

injury is of full thickness initial excision may be performed followed by grafting 4 days later

A most important phase in repair of full thickness burns is the aggressive approach to the burn wound Dead tissue must be removed as expeditiously as possible and skin coverage must be achieved with the least possible delay Grafts applied early after the burn seem to take well As the postburn progresses the percentage of graft takes decreases considerably

Eschars may be removed by repeated change of dry dressings by wet soaks or by surgical excision Split thickness skin grafts should be applied to the 3d-degree burned area as soon as the eschar is removed and the recipient site prepared In extensive burns flat surfaces may be covered with skin about 0.01-0.012 in thick Skin for areas over joints should be somewhat thicker The donor site should be the most accessible area from which skin can be taken and the area properly exposed

Skin grafts may be applied by the lay-on postage stamp or suture method If adequate skin is available the best method for applying split thickness grafts to large flat surfaces is by the lay-on method

For permanent wound closure 3d-degree burns must be grafted with autogenous skin In severely burned patients use of temporary skin cover with homografts may be life saving Homografts persist for about 30 days and serve as a biological skin dressing preventing infection and loss of body fluids

Immediately after the skin has been removed the donor area is covered by fine-mesh gauze A warm moist gauze pad is applied for hemostasis At the end of operation the gauze pad is removed leaving the fine mesh gauze over the wound. During the grafting period the blood volume must be maintained the hematocrit should be kept at 45 or above. A high protein high-calorie intake is essential and should be supplemented with vitamins

► [There is no excess material here. It is well condensed and only the pure fundamentals are offered. It should be read and reread by all who treat burns —Ed.]

General Aspects of Microbial Growth in Burn Wound are presented by T G Blocker Jr Joseph A Bass S R Lewis and Gilbert G Eade[1] (Galveston) The bacteria recovered

(1) Am. J Surg 95:309-311 February 1958.

in culture of burn wounds reflect the immediate environment. If local treatment is carried out by the occlusive method only by strictest adherence to aseptic procedures and frequent dressing changes can the wound be kept relatively free from outside contamination. Rapid saturation with exudate provides an avenue through which most bacteria may cross the dressing barrier.

If the exposure method is used, prevention of surface contamination from sources other than the deep hair follicles is practically impossible. An attempt should be made, nevertheless, to restrict superficial contamination of the wound to the patient's own flora by isolation and by observing "no-touch" technics if possible. Bacteria that reach the surface are usually kept from free proliferation by the dryness of the wound, but if a wet swab of the surface is taken, a variety of organisms can be cultured. Most often these reflect the nasal and oral flora of the patient and of personnel attending him. Of these organisms, only the beta streptococci and the hemolytic Staphylococcus aureus are of importance while the eschar remains relatively intact and adheres to the subcutaneous tissues. Because of the ability of the beta hemolytic streptococci to invade through even small breaks and to spread rapidly through tissues, producing cellulitis, lymphangitis or blood stream infection, penicillin prophylaxis is desirable.

Separation of crusts and eschars may begin as early as the 5th day after the burn if there is contact with bed clothing, maceration or cracks resulting from motion at joints. The moist, softened dead tissue provides excellent pabulum for proliferation of most organisms. No feasible method is available to prevent bacterial proliferation in open burn wounds or in eschars that show moisture at the margins or elsewhere with loss of integrity in any degree. Transient growth of a large variety of organisms will be noted. In addition to organisms normally found in the mouth and nasopharynx, contamination of the wound with enteric flora is almost invariably noted.

After premature partial loss of burned tissue or removal of the slough in full thickness burns at the optimal time, microbial growth occurs directly adjacent to viable fat and connective tissue. At this stage generalized invasion is most likely to occur unless early grafting can be accomplished.

With formation of granulation tissue on the burn wound, an effective mechanical and functional barrier is again established because phagocytic elements prevent significant invasion of the tissue even though sterilization of the surface cannot be achieved

Preparation of an area for skin coverage should aim at appreciable reduction of the organisms present, as well as removal of all nonviable material that may serve as nutrient for bacteria or interfere mechanically with the success of grafting procedures

► [Study of this article gives one an insight into the values of a clear concept of the microbial growth in the burn wound. A large number of the complications encountered are more clearly understood and as a result one can more efficiently cope with them. The authors are to be commended on the beautiful execution of their research.—Ed]

Pitfalls in Management of Burns are discussed by Michael L. Mason John L. Bell and William B Stromberg Jr [2] (Northwestern Univ) The sole aim of first aid is to protect a burn from further injury and contamination This may be accomplished by covering the wound with a sterile dressing or with clean cloths if dressings are not available The application of drugs ointments or the usual home remedies may lead to contamination of the surface

Local care of a fresh burn consists essentially in gently cleansing the surface, removing gross debris loosening tissue tags and protecting against further injury and contamination In cleansing strict adherence to aseptic technic is necessary A fine mesh gauze (cotton nylon rayon) dry or lightly impregnated with petrolatum 1 layer only laid directly over a burn tends to prevent dense adherence of dressings and permits drainage. It should also be sufficiently thin to permit appraisal of the burn surface when the bulky outer dressings are removed 5-8 days later

The compression or contour dressing laid over the initial layer of fine mesh gauze must be thick enough to afford even compression Tight constriction and pressure over bony points are to be avoided The pitfall here consists in assuming that an elastic bandage affords compression and thus in wrapping the bandage tightly over insufficient dressings

The surest, quickest way to secure early healing and regain maximum function is by early replacement of destroyed skin by skin grafts If a burned hand is immobilized in the

(2) S Clin. North America 38 103 114 February 1958.

position of function dead tissue may be removed in 5-7 days and skin grafts applied With subsequent immobilization in the functional position until these grafts have healed, the patient has the best chance of rehabilitation.

In open treatment the surface should be cleansed initially and guarded against possible contaminants until the dry impervious crust has formed Likewise, encircling burns can be treated only with difficulty by the open method. When necrotic slough has separated open treatment must be abandoned and granulating areas protected from contamination until covered with skin No matter how carefully the cleansing has been done, the dressings applied or open treatment instituted infection may develop despite liberal doses of broad-spectrum antibiotics Elevation of the temperature beyond 100 F should be assumed to result from infection and not burn toxin

With full thickness loss slough should be removed within the first 2 or 3 weeks Surgical excision under anesthesia is the generally accepted procedure for early slough removal. It is applicable to almost all body areas Burns of face and neck should rarely if ever be excised as the blood supply in these areas quickly separates the slough, making excision unnecessary

In moderate-sized burns where donor sites are plentiful, the surface is measured accurately with patterns of 2 or 3-in. gauze placed over the raw area. The length and width of the strips are recorded and corresponding lengths of skin can be taken with assurance of full coverage If there is not enough graft skin, it is often possible to secure coverage with postage-stamp grafts i e. split grafts cut into pieces about ¾ 1 in square.

The most reliable guide to adequate fluid administration during shock is the urinary output, checked hourly for amount and specific gravity The output should be about 25-50 cc./hour with a specific gravity of about 1 016. A low urinary output may erroneously be assumed to indicate renal shutdown It can be avoided simply by increasing intravenous fluid intake.

A severe burn requires more oxygen carriers since many red cells have been badly damaged. The use of whole blood helps to rectify this situation and also to combat secondary anemia.

Restlessness and agitation are often mistaken for pain, with the result that morphine or other sedatives are given. These symptoms are more often due to cerebral anoxia and indicate need for increase in intravenous fluids. In severe burns of the face and neck, a tracheostomy tube inserted early before actual obstruction develops may be lifesaving. It also adds to the patient's comfort. When skin has been destroyed, a booster dose of tetanus toxoid or antitoxin is advisable.

One of the most subtle dangers is the gradual development of joint contractures in a bedridden patient. These may result even if the part is not actually burned. In such instances simple splinting and exercises suffice to prevent contractures. When the area has been burned, splinting does not suffice and the raw surface of the burn must be skin grafted early.

► [One seldom finds a greater collection of pearls in one package. This article is so full of fundamentals necessary in the management of burns that I felt the urge to memorize the entire contents.—Ed.]

Relationship between Airborne Bacteria and Organisms Recovered from Children in Burns Unit. E. J. K. Penikett, G. B. Skinner and R. Knox[1] tried to discover to what extent the air could be incriminated as a vehicle of cross infection in a burns unit. No attempt was made to assess the contribution which may have been considerable, by other factors such as human carriers. The air conditions within the burns unit were clearly different from those immediately outside. The total bacterial population of the air within the unit was considerably lower than in the corridor, but there was higher incidence of staphylococci, and these tended to be more antibiotic resistant than those outside. The probable explanation was that activity within the unit was lower than in the corridor, but the patients whose burns were infected provided a reservoir from which the air could be recharged with staphylococci. Air movement, judged by the smoke test, was sluggish and the lack of controlled ventilation was unsatisfactory from a medical viewpoint as well as for the comfort of the patients and staff.

The extremely low levels of relative humidity did not apparently influence the air counts greatly but are undesirable for patients in whom chest infections are likely to develop.

The commonest pathogen isolated from the air and from

(1) Guy's Hosp. Rep. 107:69-85, 1958.

the patients lesions was Staphylococcus pyogenes and about 80% from both sources were sensitive only to chlor amphenicol and slightly so to erythromycin This "resident staphylococcus seemed well established in both of the rooms provided by the unit In view of the difference in incidence and antibiotic pattern of the staphylococcus found in the unit, as compared with the ward immediately outside and served by the same attendants it seems reasonable to assume that at least one reservoir lay within the unit The secondary treat ment room was never empty during the investigation so the infection may have been maintained by the succession of pa tients The primary treatment room was emptied aired, washed down and fumigated twice, but newly burned pa tients admitted to it became infected with the resident staph ylococcus within a short time Any benefits from fumigation were short lived if indeed it succeeded in killing the staphy lococci at all

It was established that the organisms from the air showed the same characteristics as those infecting the patients. Earlier use of settle plates in the unit showed that these or ganisms could be isolated by this means indicating the likelihood that fall-out of infected particles was one way in which cross infection could have occurred. Air samples did not reveal proteus or Pseudomonas pyocyanea in parallel with incidence of these infections in patients This was probably accounted for by the poor survival of these genera in the air

There was a tendency for resistance to chloramphenicol to develop although the drug was little used This could be explained if there was cross resistance between chloram phenicol and tetracyclines

Nutritional Aspects of Care of Burned Patient are presented by Harold A. Harper[4] (Univ of California) Immediately after a burn priority is given to treatment of shock and maintenance of fluid and electrolyte balance Although severe nutritional problems are simultaneously presented little can be done at this time to cope with them The most serious nutritional problem is attributable to the great loss of nitrogen Negative potassium balance of 2 5 Gm. daily also occurs immediately after burning but in contrast to that

(4) Plast. & Reconstruct Surg. 21 389-392 May 1958.

of nitrogen it may become positive within a few days if potassium intake is increased

Prolonged negative caloric and nitrogen balance are incompatible with the welfare of the organism as a whole even though the healing processes may not immediately reflect this fact The actual caloric and protein needs of the burned patient will be highly variable depending on the extent of the injury and depth of the burns It is probably desirable to attempt to provide 50-80 calories and 2 3 Gm protein/kg body weight. These requirements cannot be met if only the parenteral route can be used although the use of fat emulsions intravenously has greatly improved the nutritional adeqnacy of a parenteral regimen

When convalescence is prolonged it will probably be necessary to resort to some type of tube feeding This can be accomplished by a small polyethylene inlying gastric tube that can be left in place for several weeks without discomfort to the patient and without interfering with his ability to take food in the normal manner Tube feedings should be started slowly at rates of not over 40-50 ml /hour for adults Daily vitamin intake should be increased above that recommended for healthy persons

Anesthetic Management of Severely Burned Child. D LeRoy Crandell and Charles E Whitcher[5] used the following method of treatment in 8 children aged 8-10 burned in a school fire.

TECHNIC.—Concomitantly with the replacement of circulating blood volume, a clear airway with adequate alveolar ventilation was established to prevent hypoxia and hypercapnia. If edema of the glottis and larynx or thermal injuries of the oronasopharynx were present, a tracheotomy was done immediately In 2d and 3d-degree burns of face and neck, a tracheotomy was often indicated. Cicatricial contractures of the neck, which subsequently developed from 3d-degree burns, would have made endotracheal intubation difficult and hazardous. Tracheotomy permitted the multiple anesthetic procedures subsequently required.

Hypoxia associated with increased capillary permeability decreased plasma colloidal osmotic pressure and inspiratory obstruction, with increased intrapulmonary negative pressure, precipitates fulminating pulmonary edema. Treatment includes maintenance of a clear airway use of intermittent positive pressure with oxygen to correct hypoxia and reduce the pathologically elevated negative intrapulmonary pressure, and administration of concentrated serum albumin or plasma. A low Fowler position and tourniquets on the

(5) South. M. J 51:913-918 July 1958.

extremities in rotation help to reduce thoracic venous pressure.

The treatment of restlessness due to cerebral hypoxia took precedence over other therapy. Cerebral hypoxia in a severely burned patient usually results from decreased circulating blood volume or impairment of respiratory exchange.

If psychic reaction to pain, such as apprehension and fear, predominated, a barbiturate often provided satisfactory sedation. Deep 2d-degree burns required morphine. When narcotics were used for pain relief, small doses in dilute solutions given intravenously often sufficed. Sustained relief was provided by 0.1% procaine drip or a narcotic drip (15 mg. morphine in 500 cc. fluid).

After the initial state of acute burn, a form of basal hypnosis was needed because of the multiple surgical procedures indicated. A 5% solution of a thiobarbiturate in a dose of 3.5 mg./kg. given in a deep intramuscular site proved satisfactory. Hyaluronidase was used to facilitate absorption. Adequate basal hypnosis occurred in 5 minutes and lasted about 2 hours. Scopolamine hydrochloride 0.4 mg., was given in combination with a thiobarbiturate. No tissue irritation was noted. Intramuscular succinylcholine 2 mg./kg. and topical anesthesia with 5% Cyclaine® or 2% Xylocaine were used to facilitate endotracheal intubation. Nitrous oxide analgesia was usually sufficient for changing dressings and for debridements. Nitrous oxide supplemented with cyclopropane, meperidine, diethyl ether or Fluothane® furnished the additional analgesia required for skin grafts and plastic repairs. A nonrebreathing technic using a mask or endotracheal tube was preferred. In some instances, cyclopropane or Fluothane® was used with a semiclosed technic to fortify the analgesia maintained with equal flows of nitrous oxide and oxygen at a total flow rate of 4 L./minute. Adequate anesthesia usually was attained with 0.6-1 vol. % Fluothane® delivered from a Foregger "copper kettle" vaporizer. The breathing bag was routinely compressed manually to insure adequate alveolar ventilation by compensating the tidal volume.

Plastic Surgery in Radiation Burns is discussed by Ernesto F. Malbec and Jorge V. Quaife[6] (Buenos Aires). X-ray burns are subject to preliminary treatment before the appropriate time for surgical action arrives.

In 1st-degree radiodermatitis, pads soaked in normal saline solutions are used. Creams containing white codex water and magnesia may also be convenient. The most important point is to prevent or eliminate infection by use of ointments with antibiotics. Caustic substances must be avoided. Particular attention must be given to 3d-degree radiodermatitis, which presents ulceration and abundant mortified, sloughing tissue. Its bed is an excellent breeding ground favoring microbial spread.

Generally, radioulcerations tend to grow in extent and in

(6) Plast. & Reconstruct. Surg. 20:232-245, September, 1957.

depth Added micro and macroinfections ordinarily prevail over irradiation action In some instances operation is required to eliminate necrosed tissues which maintain infection In others accumulation of pus or secretion or fistulization compel the same course The symptom of pain nearly always forces operation Extirpation of tissue in surface and in depth must be compatible with immediate suppression of pain

If possible, the raw area must be grafted immediately with



Fig. 211 (left) —Chronic radiodermatitis, 3 years after x-irradiation.
Fig 212 (right) —Excision. Surface is covered by full-thickness free skin graft. (Courtesy of Malbec, E. F., and Quaife J V Plast. & Reconstruct. Surg 20 232 245 September 1957)

medium-split skin in strips or in stamps Thus primary healing is obtained and infections that tend to maintain persistence of the process are avoided Immediate wound repair can be done when the lesion is small and sufficiently limited. Here it is possible to avoid grafting Flaps from the neighborhood or from a distance may be used

If despite elimination of the radionecrotic focus the surface does not offer possibilities of a good take even for an extremely thin graft, it is left uncovered to await granulation and spontaneous epithelization If this does not occur after a certain time and local conditions have improved grafts are applied Chronic radioulcerations require radical excision. Spontaneous healing must never be expected

If the ulceration is small once the lesion is excised the pos-

sibility of local skin sliding must be considered. If this is not practicable local skin flaps can be transferred. Flaps afford better cover than grafts and are less likely to change color However they have enormous limitations in direct relation to size and localization of the affected zone. Generally the authors resort to thick split or full thickness skin grafts (Figs 211 and 212) especially if the raw area resulting from the excision is of good quality If the excised surface is large but well vascularized three-fourths or split skin grafts are applied In large areas resulting from excision of suspected or proved malignant lesions and in areas having poor vascularization or a septic aspect, extremely thin grafts are applied When definite repair with grafts is planned, excision of sclerotic tissue with poor circulation and possibly also affected by radiation must be complete Otherwise, the grafts will be invaded by fibrosis finally ending in a new ulceration as bad as that formerly excised.

Biopsy of the extirpated zone must be done systematically with special study of the borders of the ulceration The search must be continued millimeter by millimeter until healthy tissue is found

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RECONSTRUCTION

Surgery of Temporomandibular Joint. Stuart D Gordon[7] (Toronto) describes various lesions and their surgical treatment

Unless subluxation (clicking joint) is too distressing to the patient it is wise to postpone surgical intervention Many patients may be relieved by adjustments of occlusion. If the symptom is severe if movement is restricted or abnormal or if there is a story of locking operation is indicated. The most widely advocated procedure is excision of the intra articular disk As this results in the molars on the shorter side meeting before those on the other the author for the past 3 years has been replacing the disk with a polyethylene cap which fits snugly over the head of the mandible. All joints so treated function normally with no evidence of faulty occlusion but follow up is too short for final judgment

(7) Am J Surg 95 263-266, February 1958.

Though dislocation occurs by far most often anteriorly it may occur posteriorly medially, laterally or upward In anterior dislocation reduction can be done without anesthesia. In manipulating a dislocated jaw the mouth should be opened wider and then while pressure is exerted on the molar region the chin should be brought up and forward After successful reduction the author wires the upper and lower teeth together so that only 1 cm of active opening is possible. They are left fixed for 3 weeks Recurrent anterior dislocation can be treated effectively only by open operation Formation of a new external ligament by use of a strip of fascia lata passed through drill holes in the zygomatic arch and condyles is advocated Of 18 patients operated on by this method none have had another dislocation Except for anterior dislocation dislocations of the temporomandibular joint are accompanied by fractures of the mandibular condyle or an associated structure

Arthritis of the temporomandibular joint may be acute or chronic. If diagnosis of acute suppurative arthritis is made within 24 hours the joint may usually be saved by its being opened, the pus evacuated and open drainage instituted. Of 3 patients operated on 1 was cured by excision of the mandibular head 1 still had pain after operation and 1 obtained complete relief Operation was done on 5 patients with Marie-Strumpell spondylitis in whom marked trismus developed and a section of condyle was removed Union was prevented by capping the lower cut edge with tantalum Clinical results were satisfactory

Ankylosis may result from birth injury or a badly comminuted fracture of the condyle and zygomatic arch Treatment is as for fusion from any other cause resection of part of the condylar neck and interposition of some substance to prevent union

Muscle Plastic Operations for Facial Paralysis Herbert Conway[8] (New York Hosp -Cornell Med Center) reviewed 326 cases of facial paralysis In most instances of traumatic palsy the nerve was excised or damaged during operation

Bell s palsy was seen in 105 patients In 15 of 36 cases of failure of recovery from Bell s palsy surgical procedures were credited with achievement of good results Patients

(8) Ann. Surg. 147 541 552 April, 1958.

with Bell's palsy were not subjected to operation until at least a year had elapsed after onset of paralysis Intracranial inflammation such as herpes zoster polioencephalitis meningovascular syphilis radiculitis meningitis ganglionitis typhoid encephalitis and diphtheria was the cause of paralysis of the 7th cranial nerve in 26 instances Extracranial inflammation caused the paralysis in 23 with spontaneous recovery in 12 Invasion or compression of the facial nerve by tumor was the cause in 17 patients

Reparative surgery was carried out on 108 patients Since each patient was considered a special problem various procedures were used Reparative nerve surgery, usually by the technic of anastomosis of the hypoglossal or the spinal accessory nerve to the facial nerve, was undertaken in 25 cases With the latter procedure, the descendens hypoglossi was also anastomosed to the distal end of the spinal accessory nerve Results were very good in 16 cases After successful anastomoses of cranial nerves maintenance of muscular tonus was the rule.

The use of fascial slings alone was disappointing the weight of the tissues in the absence of animation is such that repeated procedures may be necessary to hold the affected side of the face in symmetry with the opposite side. Reanimation by transplantation of muscles was carried out with acceptable return of function in only 10 (55%) of 18 patients with proper follow up Patients subjected to this procedure are not the most favorable since transplantation of muscles is not used except in those whose paralysis is of at least 1 year's duration Patients in this group seemed better able to re-educate themselves to synchronize trigeminal nerve function on the affected side with facial nerve function on the unaffected side than have those in whom peripheral nerve anastomoses have presumed the voluntary co-ordination of function of the hypoglossal or spinal accessory nerves with that of the facial nerve on the opposite side Redirection of function of the temporal muscle to effect movement of the lower half of the face (McLaughlin technic) was more effective than the Lexer Rosenthal procedure, in which the masseter muscle is utilized to assume this function

as its blood supply and innervation remain intact By this technic Schottstaedt has transplanted the sternocleidomastoid to the face in substitution for masseter function with excellent results in 3 or 4 patients In the author's experience with this procedure, limited to 1 patient the result was poor because of necrosis of the mobilized sternocleidomastoid muscle

In the author's series the most commonly used technic was outer canthoplasty with the Kunt Szymanowski or the McLaughlin procedure 7 of 10 patients had an acceptable relief of epiphora with improved appearance

Surgical Treatment of Defects of Scalp is described by Reed O Dingman[9] (Univ of Michigan)

TECHNIC.—Radical debridement has no place in management of scalp lacerations. Only obviously devitalized portions of the scalp should be discarded. Small scalp defects can often be closed by extensive undermining in the loose subaponeurotic layer Larger defects with loss of superficial scalp layers may require repair with free or pedicle flaps If the scalp loss is extensive, split thickness skin grafts can be successfully applied to the defect to obtain a closed wound. Sheets of split thickness skin cut with the dermatome from the thighs or abdomen and placed on the intact pericranial layer give good results If the pericranium is torn away and the cranium exposed, it is imperative to provide immediate covering for the bone. If denuded bone deprived of its blood supply is not immediately covered, bone necrosis and sequestration are highly probable. Free grafts of split skin have no chance of "taking" on the outer table of bone. If possible a flap should be outlined and rotated over the exposed bone area for coverage.

Scalp flaps can often be rotated or transposed when it is desirable to place hair bearing tissue in strategic positions. In preparing the scalp flaps the skin, subcutaneous tissue and galea aponeurotica are raised as one layer The flap is based at the periphery of the scalp and positioned so it contains adequate vessels for arterial flow and venous return In general the 2 1 ratio of length to width provides a safe transposition-type of pedicle flap in the scalp In areas where larger arteries and veins are included in the flap greater liberties may be taken.

If the principle of early closure of scalp wounds has been closely observed, definitive procedures can be deferred if necessary for months or years after closure Such procedures may be necessary to improve appearance or to reconstruct soft tissue or bone defects so as to restore function. Split skin grafts placed on the dura do not provide adequate covering for reconstruction of the skull. Wherever bone grafts are to be placed, full thickness skin is necessary to provide adequate blood supply This may be accomplished by local scalp flaps placed over the brain immediately after excision of the split skin

(9) J Internat. Coll Surgeons 30 148-161 August 1958

graft. The donor defect can be covered with split skin graft placed on the pericranium. After the flap has become adequately established it may safely be elevated and bone grafts placed for skull reconstruction.

Industrial Injuries of Foot are evaluated by Charles I. Stress[1] (San Francisco). After surgery, the condition of the foot may be vastly improved over that which had been present before surgery, but before its potential in function can be judged, this foot must also be compared with the condition before injury. Army surveys dealing with young adults disclose many foot disabilities, and the incidence of such problems is naturally greater in the industrial age group ranging from the young adult to the worker aged over 60.

Many common chronic foot disabilities will have definite bearing on eventual rehabilitation. Over many working years any of these ailments may have become aggravated by occupation, poor posture, badly fitting shoes, obesity or other factors. The accident plus prolonged bed rest will have further altered the physiologic picture even in the normal foot.

Rehabilitation of each patient should be under the direct guidance and supervision of the surgeon who cared for the patient during the reconstructive phase of treatment. By close supervision any complaint of pain can be investigated and evaluated early and thus many complications that prolong disability may be avoided—the pressure point that may lead to ulceration of the flap or development of callus, the trigger point that may initiate causalgia, tender scars which must be protected to avoid compensatory faulty weight bearing, and contractures which must be relieved.

The theory that the "whole patient" deserves the surgeon's attention is nowhere more applicable than in treatment of foot problems.

► [Industrial injuries of the feet have never been properly evaluated. As a result many complications resulting in limitation of function, amputation, etc., have been noted. The author evaluates many of these problems and recommends new concepts in the management of them which, if followed, will appreciably reduce complications.—Ed.]

Reconstruction of Harelip Nose. For 10 years Claire L. Straith, Richard E. Straith and James M. Lawson[2] (Detroit) have improved one-sided nasal deformity left after repair of a lip cleft by use of a Z plasty in two planes (Fig.

(1) J. Internat. Coll. Surgeons 30:266-2?3, August, 1958.
(2) Plast. & Reconst. Surg. 20:455-465, December, 1957.

213) one flap on the skin side of the nasal tip and the other on the mucous membrane side This elongates the columella on the affected side and makes the nostril more oval When the wound is opened a small properly shaped piece of carti

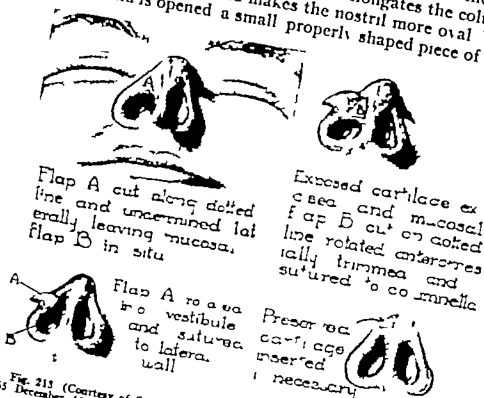


Fig. 213 (Courtesy of Straith, C. L. et al Plast. — Reconstruct. Surg. 20 455-465 December 1957)

lage or bone can be inserted under the skin to build up the nasal tip to a proper proportion This method has now been adapted for reconstruction of double harelip noses

TECHNIC.—*Flap A*—The midline of the nasal tip is determined. The desired height at the center of each nostril is marked. A curving mark is made from the top of the nostril down toward the edge of the columella on each side. Incision along this line is made on one side and from the lowest point at the columella out along the edge of the overhanging veil of skin to the lateral wall. This flap is carefully dissected up and held out with a suture or hook.

Flap B—Alar cartilage is also overhanging and closely attached to the vestibular skin of Flap B but it should be dissected off carefully and the anterior edge of the cartilage excised well back within the nostril unless the cartilage is to be preserved as a tip. When this alternative is used the lower lateral cartilages are carefully dissected off Flap B and turned upward into a pocket undermined in the columella and nasal tip and sutured back to-back with mattress catgut sutures. Flap B is made by incising from the alar rim under the roof of the nostril back toward the septum under the edge

of Flap A Flap B is everted toward the septum, the excess is trimmed off from below upward and the edge sutured to the columella. The upper end of this flap should be turned outward to make a rounded top on the nostril Flap A is now turned into the nostril and trimmed to fit the denuded area and sutured with 5-0 catgut.

The operation is repeated on the other side. A tunnel is prepared in the columella and the nasal tip is undermined A fairly narrow notched base cartilage implant is inserted. Flaps are then sutured into place with fine silk.

At the same sitting or later other reconstructive procedures often need to be done. Abbe flaps can be used to widen the upper lip border Hump nose corrections often improve appearance Bird wing excisions of skin can create a new Cupid s bow and eversion of the mucous membrane to this new line shortens the vertical length of the lip and eliminates the central third of the lip scar which follows a Hagedorn double cleft lip operation The Weir operation used to nar row the nostril floor sometimes produces a kink in the alar rim which can be improved by a wedge excision at this point Then the defect can be closed with tension sutures inside and subcuticular ones outside Dentures may add further im provement The double Z plasty seems to accomplish elon gation of the columella without additional visible scars to nose or lip and if combined with a cartilage graft or flap for support, the appearance of these patients may be improved greatly

Plastic Repair for Total Loss of Mandible John B Erich[3] (Mayo Clinic) recommends an intraoral prosthesis for reconstruction in total loss of the mandible. Until recently he attempted to repair such deformity simply by constructing a prosthesis which was inserted into a surgically prepared skin lined pocket in the mouth In the past 2 or 3 years a more desirable esthetic and functional restoration has been effected by the combined use of a tubed flap of skin and an in traoral prosthesis. This technic involves preparation of a clavicular tube flap which is elevated and eventually inlaid horizontally between the chin and floor of the mouth This transference of soft tissue eliminates the pull of scar tissue from the lower lip

Method.—In preparation of the tubed skin graft, a double pedicle flap of skin is elevated and tubed obliquely across one clavicle. One month later the supraclavicular end of the tube is detached and transferred to one or the other of the submaxillary regions. Three

(3) Am. J Surg 94 851-856 December 1957

weeks later the infraclavicular end of the tube is cut off and transplanted to the opposite submaxillary region After 3 more weeks a horizontal incision is made from the submental region into the oral cavity This cut, which completely frees all attachments of the chin and lower lip from the floor of the mouth, is situated just anterior to the scarred ridge. The tube flap can then be wedged into this incision to force the lower lip and chin forward. Horizontal incisions along the anterior and posterior surfaces of the tube divide it into an upper intraoral portion and a lower external part. The edges of the skin of the upper half of the tube are sutured to the oral mucous membrane The edges of the lower part of the tube are stitched to the adjacent margins. The skin on the upper surface of the tube flap then forms the epithelial lining of the mouth between the lower lip and floor of the mouth The skin on the undersurface of the tube becomes part of the external skin covering of the submental region. No fat in the tube is disturbed so a bulk of soft tissue remains behind the chin to hold it forward and prevent subsequent contracture.

After the tubed flap is completely healed in its new position a lower alveolar ridge is created to help prevent the prosthesis from slipping around in the mouth. Such a ridge is prepared by an incision through the intraoral part of the tubed flap just anterior to the scarred ridge. This incision is carried down into the underlying fat of the tube and back under the scarred ridge. When this incision is spread, a fairly large pocket is produced for reception of the proposed prosthesis To prevent obliteration of the pocket by scar tissue the cavity must be lined with a skin graft. An acrylic prosthesis with lower artificial teeth to occlude with the patient's upper teeth or dentures is prepared by a dentist This appliance is made to fit over the scarred ridge in the floor of the mouth and into the skin lined pocket.

Reconstruction of Thumb according to Sterling Bunnell[4] requires plans for giving position stereognosis and motion If a hand is without a thumb a new thumb can be made by a bone graft and a tube pedicle of skin that will be useful only if the other digits have sensation and can work against it. Even if the wrist alone moves well a prosthetic thumb can be placed where the rest of the hand can work against it using the wrist as a motor and supplying in addition a small split hand hook. A post for a thumb or even a prominent hump on the base of the palm is useful if the fingers are movable because a short thumb is a good thumb When possible a tongue of good tactile skin should cover its working parts placing it by Z plasty from the vicinity Such a thumb can be constructed in one procedure followed by one more to disconnect the pedicle.

TECHNIC.—The scar is excised and skin borders on the hand are

(4) Am. J Surg 95 168-172, February 1958.

undermined. The bone base is shaped and a post of cancellous bone from the iliac crest is carved and broadly based on the trapezium or scaphoid bones and pinned firmly A tube pedicle is then raised in one procedure and sutured in place over the bone post. If possible, a flap of skin with sensation is swung over the tactile part of the post. Fluff pressure dressings are applied. A scultetus bandage is passed across under the back and its tails are brought around and incorporated in the half plaster cast that holds the hand in place for the next 3 weeks. All incisions that result in contracting line scars should be placed so they do not coincide with motions that give push and pull thus resulting in lines of hypertrophic contracture and flexion contractures.

Phalangization is deepening an interdigital cleft so the metacarpals will act as phalanges It is extremely useful in widening a thumb cleft or when digits are too short and need independent motion for prehension If there is a web a large Z plasty may suffice but if the skin is insufficient to cover the cleft 1 or 2 metacarpals may be removed By removing the index metacarpal the thumb cleft is widened and deepened and the thumb can work well on the end of the 3d metacarpal. By removing the metacarpal of the ring finger a new digit is provided and this 5th digit has as much as 2 in. of motion at its tip when freed from its fellows Such a 3 fingered hand is useful

Pollicization is a good method of constructing a thumb provided that movement stereognosis and positioning may be achieved Bunnell made the first such thumb in 1929 Nerves and blood vessels were transferred using a skin bridge. All the tendons were transferred and extra tendons were connected for considerable added strength. The patient worked as well and as fast as his fellow carpenters for 19 years A further advancement in pollicization is use of the neurovascular pedicle and elimination of the skin bridge. In 1951 Bunnell transferred a whole digit completely circumscribing it and transferring it on a neurovascular pedicle and some tendons The nerve to the 2d interdigital cleft was split to the base of the palm so that each nerve branch was preserved At the distal palm the arterial branch to the adjoining finger was tied. The distal third of the metacarpal of the index finger was pinned by Kirschner wires to the stump of that of the thumb The transferred digit had good circulation and normal sensation. Later the tendons were connected. In pollicization by eliminating the skin bridge great versatility is given in placing the thumb in its opti

mum position By retaining the blood and nerve supply of the thumb its vitality is maintained and it can be placed in optimum position The tendons may be carried over They may be lengthened or shortened or adjoining tendons may be transferred to the thumb for added motion or increased strength

► [The depth of understanding of all difficult problems in hand surgery usually found in all treatises written by Dr Bunnell is to be enjoyed in this, one of his last written articles. Much of the true value of the thumb as it relates to the hand is elaborated on by the author He also makes clear many troublesome aspects involving these reconstructions which could be related only by a true master —Ed.]

Major Resection of Scalp and Skull for Cancer with Immediate Complete Reconstruction—14 Cases John C Gaisford Dwight C Hanna and Anthony F Susen[5] (Univ of Pittsburgh) treated 13 men aged 47-82 and 1 woman aged 50 for cancer that affected the temporal bone in 7 the frontal bone in 4 the parietal bone in 1 and the occipital bone in 2 Treatment consisted of excision of the primary tumor with or without radical neck dissection in continuity and immediate reconstruction by adjacent flaps or split free skin grafts In every patient it was possible to complete excision and reconstruction in one stage In 1 patient, an asymptomatic coal miner who felt insecure with a pulsating scalp replacement was performed 53 months after the original resection

Results after definitive treatment were encouraging This group admittedly was selected because many were turned down as being completely nonresectable. Of the 14 patients selected 12 were definitely helped by surgery for variable periods Ten are alive and tumor free whereas 4 died of the disease for which they were treated. None of the survivors is handicapped to any great degree by the type of treatment carried out. Pedicle flaps and split free grafts applied directly on the dura, with resultant pulsating areas did not elicit complaints from 13 of the 14 patients operated on A pulsating area is not considered to be a particularly dangerous state. Postoperative morbidity was minimal.

► [Many enviable results are shown as the result of the authors heroic and ingenious approach to the management of extensive cancer in this area. It is still important, however to remember the axiom of imposing a year's delay in repairing massive defects resulting from excision of a cancer lest a patient be subjected to futile surgery done in areas of residual disease.—Ed.]

(5) Plast. & Reconstruct. Surg 21 335-344 May 1958.

Forehead Flap in Nasal Repair Jean Bernard Escoffier[6] *(Paris) discards any procedure that uses the upper limb* as a direct or indirect supply of tissue for the face because such procedures are tedious painful unnatural and in most instances avoidable. The end result is often less satisfactory functionally and cosmetically Tubed flaps from the neck, acromiothoracic region or even dorsal region are of value when a forehead or adjacent flap cannot be used No skin from any other body part can compete with the skin of the face for facial reconstruction Adjacent flaps free grafts and particularly composite grafts from the ear have specific indications for repair of the tip alae columella or a small defect of the nasal bridge.

Despite the slight disadvantage of subsequent scarring on the forehead many plastic surgeons prefer the forehead flap Distinction should be made between the broad sickle and plain forehead flap The broad sickle flap can be useful and even essential for extremely extensive repairs but the procedure is lengthy and involves excessive bleeding and requires temporary and therefore wasteful free grafts with further mutilation In most instances the plain forehead flap is the most satisfactory method of nasal repair because it is simple needs no specialized equipment and is possible under local anesthesia The repair is fast safe involves no major shock and virtually no risk of necrosis and the patient is comfortable The scar is often inconspicuous and usually well accepted by the patient when the nasal repair is satisfactory Edema due to twisting of the pedicle is likely only if the pedicle has not been adequately freed to allow loose rotation of the flap without tension *With low foreheads it is* often possible to use a horizontal flap with supraorbital or temporal pedicle or to resort to a sickle flap

Among 16 patients median forehead and supraorbital flaps were used eight times each In 12 the repair was completed in two operations three and four operations were needed in 2 patients each. The flap was transferred immediately in 13 patients In half the patients repairs were carried out entirely under local anesthesia In 4 contiguous flaps were used in repairing nasal defects

(6) Plast. & Reconstruct. Surg. 21:94-111 February 1958.

Reconstruction of Upper Eyelid is discussed by Arthur E. Sherman[7] (East Orange N J) Many surgeons have emphasized the importance of using eyelid structures to replace eyelid structures. However there are times when one must resort to pedicle flaps as when there is severe loss of lid structures or extensive dense scar tissue in the area Nevertheless pedicle flaps should certainly be avoided when there is simply a loss of skin or full thickness loss of the tarsal portion of the eyelid

Cicatricial ectropion or lagophthalmos of the upper eyelid resulting from burns or lacerations usually requires excision of the scar tissue two intermarginal lid adhesions and a free skin graft to fill the defect. The best source of skin is the opposite upper eyelid The second choice is the posterior auricular skin If this is not available, an epidermal (thin Thiersch) graft or supraclavicular skin can be used The former is usually a poor color match and the latter too thick. Intermarginal lid adhesions are suggested for 2 3 months after the skin graft. These keep the graft stretched during the period that there would otherwise be contracture and result in a graft of adequate size and good texture A good pressure dressing such as that described by Pfeiffer is essential It should not be changed for 5-6 days The lid adhesion sutures are removed at this time and the pressure dressing reapplied for 4-5 days

So-called split grafts should be avoided in the eyelid area because of their thickness and resulting dead white color Full thickness loss of one-fourth of the upper eyelid due to congenital coloboma excision for tumors or trauma can be satisfactorily closed by the Wheeler halving repair If necessary this may be combined with a lateral canthotomy and cutting of the upper tarsal canthal ligament to give better mobilization of the lateral portion of the lid

If there is full thickness loss of half of the upper eyelid this can be satisfactorily repaired by Wheeler's method of using the Celsus Knapp sliding flap from the temporal region Incisions from the upper part of the defect and from the lateral canthus must diverge and extend well into the temporal region The lateral canthal ligament to the tarsus must be cut and the temporal conjunctiva thoroughly freed from the lateral orbital margin The temporal portion of the

(7) Plast. & Reconstruct Surg 20:323-327 October 1957

flap must be fairly thick to give good blood supply The flap must be well mobilized and it is drawn nasalward by subcutaneous gut sutures anchored to the periosteum of the orbital margin and by placing the medium silk skin sutures on a considerable slant so that they draw the temporal portion of the flap nasalward These tension sutures are only used in that portion of the flap which lies temporal to the orbital margin Burow s triangles excised above and below the temporal base of the flap give smoother closure in this area. A halving type of joint should be used to approximate the end of the flap and the nasal remains of the eyelid. This operation serves well in the elderly, because the temporal scars blend with the skin creases It does leave conspicuous scars in younger persons for whom a Hughes reconstruction is preferred The sliding flap has the advantage of taking care of the reconstruction in one operation with the possibility of a lateral canthoplasty later to correct some lengthening of the fissure When it is felt that pedicle flaps must be used an attempt should be made to keep the eyelid portion as thin as possible and the procedure should be planned so as to produce minimal new scarring

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FRACTURES

Early Treatment of Orbital Floor Fractures Byron Smith and John Marquis Converse[8] (Manhattan Eye Ear and Throat Hosp New York) believe that traumatic enophthalmos is due to enlargement of the orbital cavity the orbital fat distributed in a larger cavity no longer suffices to maintain normal protrusion of the eyeball (Fig 214) In some patients the orbital contents may be held backward by scar tissue or by herniation and incarceration of orbital tissues between depressed bony fragments Determination of the degree of enophthalmos is based on the relative position of a line projected from the lateral orbital margin to the profile of the zenith of the cornea.

Diplopia occurs in comminuted fractures of the orbital floor with downward displacement because the visual axis of the affected eyeball is not in alinement with that of the op-

(8) Tr Am. Acad. Ophth. 61 602-608 Sept.-Oct., 1957

posite eye A comminuted fracture involving the floor of the orbit whether or not diplopia is present, requires surgical measures if enophthalmos and diplopia are to be relieved or prevented Diagnosis of fracture and evaluation of displacement of fragments is relatively easy in fractures involving the zygoma and rim of the orbital floor Fractures of the

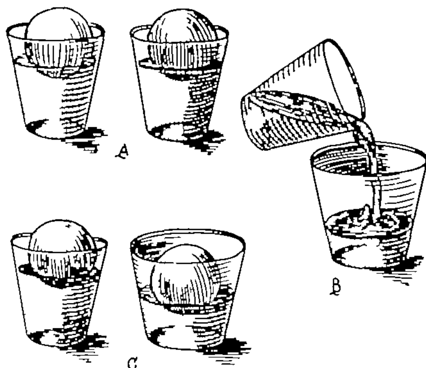


Fig. 214—Illustration of one mechanism that produces enophthalmos enlargement of orbital cavity *A* glass represents orbital cavity water represents orbital fat and ping pong ball represents eyeball. Equal amount of water in each glass maintains balls at same level. *B* water is poured from one glass into glass with larger diameter *C* ball in larger glass is at lower level though amount of water equals that in smaller glass. Thus, eyeball becomes enophthalmic when fat escapes from orbit and when orbital fat is in orbit enlarged by fracture. (Courtesy of Smith B., and Converse, J M Tr Am. Acad. Ophth. 61:602-608, Sept.-Oct., 1957)

weak portion of the orbital floor and the blow-out fracture without orbital rim involvement are more difficult to demonstrate by x ray examination. Two means of diagnosis are available in these patients laminographic examination which should be done routinely in all orbital floor fractures and direct examination of the orbital floor through the Caldwell Luc approach to the maxillary sinus

When there is evidence of extrusion of the orbital contents into the maxillary sinus through a rent in the weak portion of the orbital floor or as a result of generalized sagging of the

floor continuity and correct level of the orbital floor are best restored by iliac bone graft performed as soon after injury as possible This bone graft suitably shaped is introduced through an incision in the lower eyelid

Diplopia in Depressed Orbital Fractures Byron Smith[9] (Manhattan Eye, Ear and Throat Hosp New York) suggests diagnostic technics

Occlusion Test—Placing a small cover in front of one eye then the other allows the patient to advise the examiner about what happens to the double image. Persistence of the double image when one eye is occluded means that diplopia is monocular rather than binocular Disappearance of one image when one eye is occluded means that the patient has binocular diplopia. While the occluding apparatus is rapidly alternated from one eye to the other the patient advises the examiner of the direction in which the image seems to move. The apparent motion of the image is opposite to the direction of the motion of the eyeball From this test, the examiner may observe the motion of the eyeball and conclude whether the deviation is horizontal or vertical or both. By combining the test with prisms, the amount of ocular deviation in the various fields of gaze may be estimated. *Interpretation of the findings leads to presumptive diagnosis as to the specific muscles involved.*

The occlusion test is one of the more reliable tests because it has subjective and objective connotation

Red Glass Test—A simple red filter placed in front of one eye helps the patient to describe the displacement of images. A diplopia field may be plotted, but it is not as accurate as the cover or occlusion test. The red glass may be modified so that its image is perceived as a line rather than a point. The modification is known as the Maddox rod test and has the advantage of separating the horizontal from the vertical displacement by observation of the line in the vertical and horizontal meridians, respectively

Monocular diplopia is a one-eyed phenomenon and consequently represents a visual rather than an oculorotary disturbance If functional the condition is managed as any other psychosomatic disorder Organic monocular diplopia is caused by any alteration or obstruction along the visual axis conducive to duplication or multiplicity of monocular retinal images Corneal abrasions opacities in the cornea, lens or transparent media, aberrations in the iris diaphragm lens displacement disturbance of the retina and choroid, and other similar conditions may contribute to monocular diplopia

Binocular diplopia is caused by images falling on noncorresponding retinal points in the two eyes Under normal cir

(9) Plast & Reconstruct Surg 20 318-322, October 1957

cumstances the images transmitted to consciousness are the fused images from corresponding retinal points Essentially the sharply focused fused images received by the cerebral cortex from the macular areas are those registered in consciousness Images received from noncorresponding points on the peripheral retina are poorly perceived in consciousness and are used for orientation rather than for attentive fixation Binocular diplopia due to deviation of the visual axes secondary to extraocular muscle imbalance is usually encountered in the management of orbital fracture Ocular deviation and diplopia result from organic muscle changes caused by edema hemorrhage laceration fibrosis and disturbances in nerve supply eyeball displacement etc Deviation may also follow diminution of visual acuity because the normal mechanism of fusion is not sufficiently stimulated to bring about binocular vision Ocular deviation may also occur in the presence of good vision in each eye as a result of a defect in the fusion mechanism

Fractures of the orbital floor are often accompanied by restriction of elevation in the field of action of the homolateral superior rectus muscle Usually this is not due to direct involvement of the superior rectus but indicates the inelasticity of the inferior rectus In early fractures the inferior rectus and inferior oblique muscles may be incarcerated in the fracture site In late cases these muscles and surrounding tissues become so incorporated by fibrous tissue that the involved eye cannot be elevated Shortening and fibrosis in these muscles may be so great that the eye cannot be elevated with forceps applied to the tendon of the inferior rectus This is known as the traction test and affords a means for differentiating contracture or fibrosis of the inferior rectus from weakness or paralysis of the superior rectus It is also an external means for diagnosing incarceration of the inferior rectus in early posttraumatic cases

The extent of injury beyond which spontaneous recovery is impossible is difficult to determine All depressed fractures of the orbital floor should be surgically reduced and maintained mechanically Treatment of choice is direct exposure of the fracture through a skin incision If the orbital rim is comminuted into large fragments the fragments may be drilled and wired If necessary the antrum is opened through an anterior antrostomy If the orbital floor is comminuted

into many small fragments they must be supported on the surface of an autogenous iliac bone graft.

Should diplopia exist after completion of all bone work, it should be treated conservatively until further improvement ceases. Usually maximum spontaneous recovery occurs in less than 6 months. Frequent measurements of muscle deviation are necessary to evaluate progress and diagnose early muscle contractures. Any area of single binocular vision should be used, exercised and encouraged regardless of what field it may be in.

Complications of Middle Third Facial Fractures are discussed by Frederick J McCoy[1] (Kansas City, Mo.) The *middle third facial skeleton attaches to the cranium at the zygomaticofrontal, frontonasal and frontomaxillary sutures.* It is bounded below by the occlusal plane of the teeth (Fig 215). Fractures in this area are common. Among the more serious complications are those involving the cranium and cranial nerves. *Cerebrospinal rhinorrhea* often results from a dural tear in the cribriform area. Spontaneous closure within 3-6 days usually occurs, though occasionally surgical repair is necessary. Any of the first 7 cranial nerves may be injured, in which case there is usually attendant cerebral concussion. At the moment of impact there is undoubtedly marked distortion of the brain mass with stretching and tearing of the cranial nerves. The 3d, 4th, 5th, 6th and 7th nerves are usually injured in this manner. Function is usually recovered.

At other times shifting bone fragments may shear off an important nerve trunk where it passes through *its bony foramen.* When this involves the 1st nerve and cribriform plate anosmia results immediately but usually disappears. The infraorbital branch of the 5th nerve is so commonly injured in its passage through the inferior orbital fissure and infraorbital foramen *that it may* be considered pathognomonic of maxillary fracture. Impingement of the 2d nerve on the optic foramen is a catastrophic complication. Treatment is usually ineffectual and the resulting blindness is permament. Precautions must be taken to insure that the procedures used in the reduction of fractures do not produce such complication.

The eyeball is surprisingly resistant to trauma. The orbital

(1) J Internat. Coll Surgeons 30:207-219, August 1958.

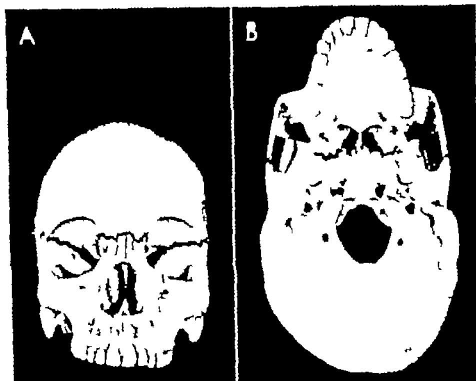


Fig 215 — *A* middle third of face delineated by frontonasal and frontomaxillary sutures centrally and zygomaticofrontal sutures laterally Inferiorly it extends to occlusal plane of upper teeth. *B* posteriorly it extends to junction of palatine bones with pterygoid processes of sphenoid. (Courtesy of McCoy F J J Internat. Coll. Surgeons 30 207 219 August, 1958.)

rim margins protect it from forcible contact with relatively broad surfaces Globe displacement often accompanies fractures of the middle third of the face Immediately after fracture dislocation of the orbital floor the eyeball will be shifted downward and backward Within minutes intraorbital edema and hemorrhage lend transitory support, masking the underlying problem Proptosis is less common and may endanger the cornea by exposure It may be due to retrobulbar hemorrhage, edema or emphysema if there is communication with the sinuses Later, retrobulbar granuloma or mucocele may be causative factors Late globular displacement is much more commonly downward and backward (Fig 216) It is usually produced by an unresolved comminution of the orbital floor so that there is loss of support as well as scar contracture into the antrum Extensive damage to the orbital floor may be present with no clinical or x ray evidence of displacement of the infraorbital rim Extraocular muscle imbalance may result from injury to the 3d 4th or

6th cranial nerve or by direct injury to the muscle or its attachments Scar adhesions may limit motion producing a checkrein effect.

Frontal force applied at the central point of the face flattens and spreads the nasoethmoid compound At times there is encroachment into the medial aspect of the orbits increasing the intraocular distance by lateral displacement

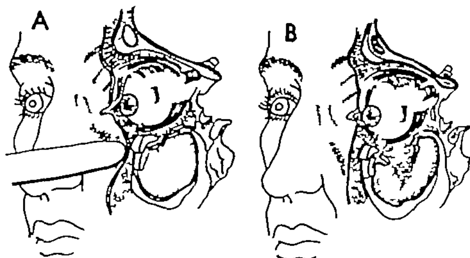


Fig 216.—*A* illustration of frontal force displacing inferior orbital margin posteriorly with comminution and telescoping of fragments of orbital floor *B* after cessation of force, bender bone springs partially back toward normal position, leaving thinner bone fragments behind, with herniation of orbital contents into antrum, and downward and backward displacement of globe. (Courtesy of McCoy F J : J Internat. Coll. Surgeons 30:207 219 August, 1958)

of the globes Forcible manipulation of the nasoethmoid arch with Asche forceps applied through small angular incisions medial to the inner canthus is effective Malocclusion is the principal oral complication Properly applied intermaxillary fixation is often necessary Trismus may result from impingement of the mandibular coronoid process against a depressed malar arch Nonunion is not a common complication of facial fractures

► [This is an approach toward a better and more accurate diagnosis of fractures of the face along with a plea for early accurate diagnosis and management of fractures of the middle third of the face. The author correctly points out the importance of this and shows the many sad complications which result when early proper management is not given. Stress is also placed on the hopelessness of these deforming states once they are permitted to develop—for they are not reversible.—Ed.]

Management of Facial Fractures in Unconscious Patients is described by Erle E. Peacock Jr[2] (Univ of North Carolina) Small soft tissue wounds should be closed immediately

(2) Am. Surgeon 4 639 646, September 1958

for best results Extensive soft tissue restorations can be safely postponed for many days with no significant ill effects

Most patients with head injuries who recover will show definite improvement during the 1st week and reduction of facial fractures should be delayed during this period. Fractures of the fine bones of the face particularly the orbit and cristae lacrimalis must be reduced within the 1st week with or without general anesthesia depending on the neurologic status Maxillary fractures also must be reduced in 7 9 days and because this necessitates interdental appliances tracheotomy is essential for comatose patients Mandibular fractures can be delayed 4 weeks if necessary provided adequate precautions are taken against osteomyelitis

Facial fractures in unconscious patients should be stabilized without resorting to interdental fixation or external apparatus by simple internal methods An exception is the badly displaced or comminuted fracture of the upper jaw which requires the lower arch for accurate reduction and temporary fixation

Mandibular fractures are usually best fixed by internal Kirschner wires that should not cross at fracture lines as rotation will still be possible The ends of the wires should be clipped flush with the skin Occasionally the wire will miss one fragment, but will engage the periosteum so tightly that fixation is adequate The only other alternative under these circumstances is to expose the fracture site and wire the fragments directly with no 26 steel wire passed through drilled holes

Dislocations of the zygoma may be reduced by inserting a hook through the skin of the cheek and elevating the bone into proper position. Occasional stubborn displacements will have to be exposed by intraoral upper labia sulcus or external hairline incision Transverse Kirschner wires drilled across the face into the opposite zygoma provide fixation that is considerably more dependable than antral packs

Multiple fractures of the orbital rim require perfect realinement because of their important role in extraocular movements and external appearance Every fragment must be identified and oriented with respect to adjacent fragments making internal reduction almost a necessity Compound fractures can usually be manipulated through existing soft-tissue wounds.

Fractures of the nasal bones should be accurately reduced as soon as possible and maintained with internal and external splints

In multiple fractures of several bones the mandible may be stabilized with Kirschner wires, the upper jaw splinted against the mandible and both jaws stabilized to the malar bone, which in turn may be secured to the angular process of the frontal bone.

► [All too frequently a patient is seen several weeks after an accident, with a horrible deformity which is irreversible, or one which does not lend itself to a satisfactory reconstruction. In many of these cases which could have been properly reconstructed early with good functional and cosmetic results it is learned that nothing was done because of shock or suspected brain damage. The author shows that proper appraisal of these cases would suggest measures which would permit early reconstruction and eliminate unfortunate complications.—Ed.]

NEOPLASMS

Management of Vascular Tumors is outlined by Kathryn Lyle Stephenson[3] (Santa Barbara, Calif) Congenital vascular tumors of the skin and subcutaneous tissues are the result of embryonic sequestrations of vasoformative tissue. The endothelial buds may form hemangiomatous or lymphangiomatous tumors Hemangiomas and lymphangiomas are benign tumors as judged by histologic analysis of the tissue. So far as the patient is concerned these tumors are not benign they are invasive and destructive. They cause deformity that is sometimes irreparable and occasionally cause death by hemorrhage or sepsis

Well trained therapists have achieved good results with various forms of radiation therapy such as radiation plaques radon implantations or external irradiation Atrophic skin subject to later carcinomatous changes alopecia, cataract or altered bony growth may result from injudicious use of radiation therapy

Although the author excises the lesion in toto in certain areas on the face and hand sclerosing solutions are preferred Occasionally two-stage surgery may be necessary to achieve the best cosmetic result. The author reserved interstitial ra

(3) J Internat Coll. Surgeons 30:229-248, August, 1958.

don seeds of 0 10-0.25 mc. for parotid tumors On the eyelid and ear, sclerosing solutions are used if the skin is involved. If the skin is intact on the eyelid surgical excision is used On the forehead the lack of available skin for mobilization and approximation is a problem and here also sclerosing solutions are of value

In the nasion area surgical excision can be undertaken satisfactorily with good results This may necessitate planned procedures Ligation of the larger anastomosing vessels and excision of the bulk of the tumor and part of the involved skin are performed at the first stage. At the second stage the residual skin tumor is removed. Both procedures are undertaken within a short period If the tumor extends down to the tip of the nose injection of sclerosing solutions offers the best result. The tip of the nose may be approached surgically from within the nostrils After excision of the tumor tissue the wound is swabbed with sclerosing solution

The lip lesion is approached from within the mucous membrane surface when possible and later sclerosing solutions are injected to control the discoloration of the vermilion border For a cheek lesion surgical excision is indicated For lesions on the thorax and abdomen simple excision is generally preferred In hemangiomas of the hand the author attempted to control the growth by ligation of the vessels above the wrist and injection of the smaller vessels in the palm and fingers Occasionally it is necessary to excise part of the involved tissue.

The light pink discoloration seen on the newborn often fades and requires no therapy The larger port wine stains generally can be satisfactorily covered with cosmetic paste which is preferable to a skin graft.

Lymphangiomatous tumors show little response to irradiation and limited response to injection of sclerosing solutions Surgery is indicated for eradication

► [An excellent approach to the proper management of this group of tumors The article reflects a comprehensive understanding of the many troublesome facets which are encountered in dealing with vascular tumors. Considerable clarification of many of the controversial aspects of these problems may be accomplished by the study of this article.—Ed.]

Treatment of Dermoid Cysts of Nose is described by Varaztad H Kazanjian[4] (Boston) Dermoid cysts result

(4) Plast. & Reconstruct. Surg. 21 169-176, March, 1958.

from the inclusion of dermal tissue along the lines of the embryonic fissures They are seen about the nose auricles floor of the mouth and palate The most obvious diagnostic feature is the sinus over the dorsum of the nose through which hair may protrude and from which accumulated secretions may be expressed A probe through this sinus tract will lead up through a tunnel between the nasal bones and nasal mucosa into a cavity in the nasofrontal area. X rays with Lipiodol[*] injection usually show the extent and size of the cystic cavity A cyst without an outlet for secretions may result in considerable distortion of the external contour of the nose especially when the cyst originates over the lower part of the nose. The external swelling is usually soft and painless unless the cyst is infected Such painless swelling may be due to sebaceous or inclusive cysts or to cysts of dental origin when there is abnormal swelling of the lower part of the nose or base of the upper lip Dermoid cysts occurring on the lower part of the face especially in the subalar region may be confused with cysts of dental origin

Dermoid cysts of the face and particularly those of the nose seldom lead to serious complications except if mistakenly diagnosed At first it seems comparatively easy to remove such cysts without resulting deformity though secondary repairs are sometimes necessary for cosmetic reasons In general surgical treatment of cystic tumors of the face (when there is an unnatural cavity within the bone) consists in exposing the cavity removing the cystic contents and membrane and eliminating the cavity The last procedure is the most important factor in treatment Besides removal of the sinus tract and cystic membrane, the cavity should be *marsupialized by removing one of the bony partitions separating it from the nasal cavity* to obtain a permanent successful result

The author followed the same procedure in operating on large dental cysts of the maxilla Dental cysts often grow large in the vicinity of the maxillary sinus or between the palate and floor of the nose. To eliminate the cavity besides removing the cystic membrane the wall separating the cystic cavity from the antrum is removed then an opening is made under the lower turbinate A large cyst of congenital or dental origin extending between the floor of the nose and

palate may be reached by anterior buccal approach to remove the cystic contents and membrane. The roof of the cyst, which is the floor of the nose, is removed and the cavity is joined with the nasal cavity The buccal opening is then completely closed This procedure may also be applied in operative treatment of dermoid cyst of the nose.

Man 35 had a history of congenital fistula over the dorsum of the nose, with occasional white discharge He also had an intraoral fistula on the right side of the frenum through which a probe could be

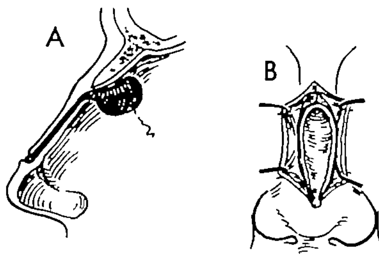


Fig 217 — A fistula over dorsum of nose, leading into large cystic cavity containing hair and sebaceous material. B vertical incision over dorsum of nose, completely exposing sinus tract. (Courtesy of Kazanjian, V H.: Plast. & Reconstruct. Surg 21:169-176, March, 1958.)

carried horizontally upward under the skin for over 1 in. X rays showed a sinus tract extending upward for 3 cm. into a large cavity over 1 cm. in diameter Operation was performed under local anesthesia, after injection of methylene blue into the sinus opening Procaine was injected over the skin of the nose and the nasal passages were packed with cotton pledgets saturated with 3% cocaine. A vertical midline incision was made extending from the dorsal fistula near the tip to the root of the nose, using the methylene blue stain as a guide. The cyst had extended beneath the nasal bone to a round pool about 1 cm. in diameter (Fig 217) The cystic membrane was completely dissected out. The cystic cavity was obliterated and permanent drainage established by making a large opening through the cystic cavity into the nose. The original wound was closed. The intra oral fistula was found to be due to an infected tooth. About 2 years later the patient reported that he was completely free from symptoms.

Correction of Combined Elongated Nose and Recessed Nasolabial Angle, according to John A Cinelli[5] (New York Eye and Ear Infirm), is one of the most difficult problems in rhinoplasty Various correction methods have been advocated such as insertion of a strut " suturing the orbicularis

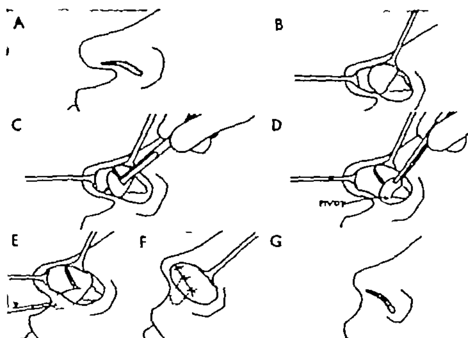


Fig. 218 —Surgical correction of long nose with pronounced recessed nasolabial angle. *A* before surgery *B* columella freed from septum. *C*, septal cartilage and mucous membrane cut, forming tonguelike flap. *D* flap rotated to fill receded nasolabial angle. *E* flap in position, nasolabial angle made obtuse, flap used as filler. Asterisk indicates gray Dermalon suture. *F* nose shortened, with nasolabial angle more prominent. (Courtesy of Cinelli J A. Plast. & Reconstruct. Surg 21 139-142, February 1958.)

oris muscle so it will pucker out thus eliminating the recessed nasolabial angle and extensive undermining of the upper lip and base of the nose. These methods have some merit, but they usually fail ultimately The author describes a method (Fig 218) that he has used for 10 years

TECHNIC.—Under local or general anesthesia, an intercartilaginous incision is made on either side of the nose and the skin undermined from side to side. This is followed by a transfixion incision. The upper lateral cartilages are closely separated from the septum along its entire length. The transfixion incision is continued down

(5) Plast. & Reconstruct. Surg. 21 139-142, February 1958.

to the anterior nasal spine. The columella is retracted and the lower margin of the septum exposed. A tongue like flap is created by incising through the anterior margin of the septum down to about two thirds of its length. The width to be incised depends on the extent of the shortening The wider the tongue flap the shorter the nose will be. It is advisable to excise the mucous membrane from either side of the flap down to the level of its lowermost incision. Beyond this point the mucous membrane and the perichondrium should be left intact.

A straight needle is threaded with plain 0 catgut suture and inserted through the tip of the flap The needle is pushed through the posterior surface of the columella at the level of its base and made to come out in front at the juncture of the columella and lip (nasolabial angle) This procedure immediately increases the nasolabial angle. The columella is sewed from top to bottom to the septum with chromic catgut 0 sutures. Stainless steel wire is used to fix the upper fourth of the columella to the upper fourth of the septum. This wire is removed in about 4 weeks.

It will be noted that the nasolabial angle is increased and the nose is considerably shortened If the columella is properly sewed to the septum, there should be no protrusion of the flap into either nostril and the lip should feel and appear normal.

Combined Plastic Surgery of Nose and Chin Résumé of 27 Years Experience Gustave Aufricht[6] (New York) relates his experience with simultaneous esthetic correction of the nose and chin by use of an osteocartilaginous nasal hump and septal tissues as transplants to the chin This method offers a broad scope for establishing proportional harmony and esthetic improvement of the entire face

TECHNIC.—Excess bone and cartilage obtained during rhinoplasty and septum resection are kept in equal parts hexylresorcinol and physiologic saline until used. Markings are made on the chin to establish the desired prominence before injection is made. The transplants are then cut to shape on a wooden board. The septal cartilage is cut into strips usually 2.8-3.5 cm long and 0.4-0.6 cm. wide. The bony fragments of the vomer are also shaped and sharp points are trimmed. The mucoperiosteal and mucoperichondral lining is carefully removed from the osteocartilaginous hump and the latter is cut to the desired size The upper segment of the alar cartilage, resected during correction of the tip is also used. The pieces are placed on each other the bone nearest to the mandible. For anesthesia 1% procaine with 8-10 drops/oz. epinephrine is used. The incision never more than 0.8-1 cm. long is placed in the submental fold. A pocket is prepared in front of the mandible for which specially designed chin elevators are used. The pocket is made directly at the periosteum but not subperiosteally It should be in the exact desired

(6) Am. J Surg 95 231 236, February 1958.

location and should not be too large or too small. To introduce the grafts a specially designed tissue clamp is used The incision is closed with 2 fine sutures The chin is dressed between adhesive loops, firmly strapped from above and below The dressing and sutures are removed after 5-7 days.

In over 700 cases grafts have had to be removed in only 3 because of infection

► [When studying an article, one inherently senses the depth of wisdom presented when it reflects the thinking of an expert and a rich background of experience. After reading this article I felt that I had had a satisfying discussion with a surgeon who by virtue of many years of study and experience, has completely mastered the problems —Ed.]

Selection of Patients for Rhinoplasty According to John B Erich[7] (Mayo Clinic) people who request cosmetic nasal operations can be divided into two categories those who will benefit by surgery and those who should be denied surgery The first group involves persons with a nasal deformity who are desirous of corrective surgery merely for the sake of improving the facial appearance. These patients leave it to the surgeon to determine necessary changes and can comprehend the fact that the end results of the operation may not be completely faultless

There is a smaller group of persons with mental and emotional problems the cause of which they ascribe to some real or imaginary nasal defect The actual reasons for such disturbances are not apparent to them but are buried in a mire of inner conflicts and emotional upheavals To such persons the nasal deformity looms as the only cause for their depressing and insurmountable problems which interfere with emotional outlook and social acceptance It seems to them that corrective nasal surgery would give an immediate sense of relief well being and self-confidence After rhinoplasty their emotional pattern continues along the same old lines with no relief from inner conflicts and no increase in self-esteem These patients are usually left disgruntled disturbed and dissatisfied with the rhinoplastic procedure

Other persons who should be denied rhinoplasty are those with shattered romances disillusionment in marriage and unsatisfactory social existence which are among life s difficulties that are never solved by altering the contour of a nose

Too often the discussion between the surgeon and patient will lead the patient to anticipate a specific type of postoperative result. If the patient is permitted to choose from stock

(7) Surg., Gynec & Obst 106 481-483 April, 1958.

photographs the type of nose that is most appealing to him then is encouraged to assume that his nose can be modified to similar proportions he is likely to be disappointed with the end results of the rhinoplasty because such precise results can by no means always be attained

► [This paper is extremely important to the surgeon performing rhinoplasties. It reflects a deep understanding of the psychologic problems so frequently found in patients involved in this procedure. The author's analysis clearly reveals many areas which could cause great concern to the physician caring for such patients.—Ed.]

Periwinkle-Shell Principle in Treatment of Small Ptotic Breast is described by Harold Gillies (London) and Hector Marino[8] (Buenos Aires) Plastic correction of the small ptotic breast is justified because of its psychologic and esthetic implications Only technics that allow shaping of the glandular content apart from the cutaneous covering can achieve permanent and satisfactory results

TECHNIC.—In the periwinkle-shell operation, a vertical incision is made in the gland down to the upper limit of the areola, allowing mobilization of the lateral quadrants which must be fully liberated from the pectoral fascia. Careful undermining with preservation of the branches of the lateral thoracic artery prevents the blood supply from being damaged. The Biesenberger technic is made possible because the parts that will be rejected are those that are deprived of circulation. In this particular technic gland resection is seldom necessary Even so the procedure is safe regarding blood supply as long as twisting of the flap remains within reasonable limits A marginal incision in the lower medial quadrant (back cut) allows for further rotation without undue tension. In the undermining the lactic ducts to the nipple need not be divided, but they will undergo a rotational twist together with the flap of breast that is to be superimposed and brought over the medial portion.

After rotation, these results will be noticed reduction of the discoid flattened gland to an apparently smaller conical shape increase of the upper flattened portion ascent of the nipple to the vertex of the cone and ascent and fixation of the whole gland to normal position.

The final step is adaptation of the skin to the glandular cone with reasonable tension Tension can be slight because the correct form of the gland makes unnecessary any attempt to modify the contents of the "brassière" by external pull This contributes to the permanence of the result and to a better vertical scar Resection and suture of the skin flaps are performed according to the usual procedure.

The periwinkle technic also has the advantage of delaying recurrence Prolapse of the gland is prevented by its rotation since the gland would first have to unroll prolapse

(8) Plast. & Reconstruct Surg 21 1 January 1958

is unlikely Also since there is little tension on the skin brassière its elasticity is not strained and the shape is maintained longer

► [The authors offer a novel approach to a most difficult problem. Many who attempt to correct this condition by means of foreign body implants would do well to study this article.—Ed]

Cosmetic Nasal Surgery John B Erich[9] declines corrective surgical treatment for many persons who manifest neurotic or psychopathic tendencies because such persons not only demand a faultlessly attractive nose as an end result but also cherish the unrealistic hope that the operation will correct everything from a sense of inferiority to a catastrophic romance. The surgeon cannot promise postoperative results in terms that are unduly precise because such precision cannot always be attained

TECHNIC.—When general anesthesia is used, hemostasis is accomplished by subcutaneous infiltration of a solution of 1.5% piperocaine hydrochloride (Metycaine® hydrochloride) with epinephrine (1 drop to the dram) along the sides of the nose and around the nostrils and columella. An intercartilaginous incision (between the upper and lower lateral cartilages) is made in each nostril. After the skin over the dorsum of the nose has been undermined through these incisions a bony hump if present, is removed with right and left bayonet shaped saws whereas the cartilaginous part of the hump is cut off with a knife that has a protected end. Improper removal of the cartilaginous part of the hump is the cause of many poor postoperative results Regardless of how small the nasal hump, removal of it calls for narrowing the nasal bridge by infracturing the bones that form the lateral walls of the nose. Otherwise, the dorsum of the nose will appear too broad and flat after the hump has been taken away

Narrowing the bridge of the nose can be accomplished by use of saws or osteotomes to detach the frontal process of the maxilla from underlying bony structures. The author prefers a chisel pressing the osteotome against the lower edge of the maxillary frontal process through the intercartilaginous incision in the nostril. With a mallet, the chisel is forced upward almost to the frontal bone Subsequently lateral pressure on each side of the nose will fracture the rest of the high attachment of the frontal process and nasal bone at the glabella and force them mesially toward the septum, thus narrowing the nasal bridge This technic often is referred to as infracturing In many instances after removal of the hump the nose will appear too long and must be shortened by removal of a triangular segment of the lower anterior part of the nasal septum

Removal of a nasal hump that is confined to the bony part of the nose is comparatively easy Similarly it is not difficult to obtain satisfactory result, but reduction of a large rounded hump involving the

(9) Proc. Staff Meet Mayo Clin. 13 204-207 Apr 16 1938.

entire dorsum of the nose is much more difficult. Although a nasal hump may be rather insignificant it is surprising what a difference removal of such cosmetic defect will effect in the patient's facial appearance. In some patients the most conspicuous part of a nasal deformity is a drooping tip that can be shortened by elevation of the tip The tips of many noses are somewhat rounded or bulbous and require not only elevation but also narrowing in horizontal and vertical direction. This is accomplished by excising through each nostril a segment of the midportion of each lower lateral cartilage at the junction of the mesial and lateral crura and by cutting away a strip of the upper border of the lateral crus

► [The author cautions against indifference to proper appraisal of the patient's psychic problems —Ed.]

TISSUE TRANSPLANTATION

Nasolabial Cheek Flap is discussed by Robert F Hagerty and Warren Smith[1] (Charleston S C) The nasolabial flap is well suited to reconstruction of defects of the lower half of the nose The texture and color of the tissues so used are similar to those of the nose, and proper contour can be effectively recreated. Large amounts of tissue are usually available from the cheek and the line of closure can be readily disguised in the normal nasolabial fold. This tissue is soft and flexible well adapted to reconstructive work. The operative procedures are of relatively small magnitude and few in number

The blood supply to the flap is favorable The main vessels run generally parallel to the long axis of this pedicled flap the facial artery extending from the angle of the mouth along the side of the nose to the medial commissure of the eye as the angular artery At its superior termination in the cheek it anastomoses with the infraorbital artery and medial to the orbit, with the dorsal nasal branch of the ophthalmic artery With transection of the facial or angular artery in the operative procedures the anastomosis with the internal maxillary (infraorbital branch) and internal carotid artery (dorsal nasal branch of the ophthalmic) provide an excellent blood supply through the superior base of the flap Though venous return readily finds its way through the nasofrontal and ophthalmic veins the lymphatics have no alternate

(1) Am. Surgeon 24 506-510 July 1958

routes to follow For this reason nasolabial flaps are apt t remain edematous several months postoperatively

In treatment of malignant neoplasms complete resection is important Where the extent of a large penetrating lesion is in doubt excision only should be the initial procedure and reconstruction deferred until after histologic examination of

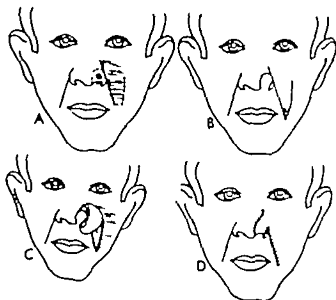


Fig 219 —Technic for nasolabial cheek flap. *A* bipedicled flap elevated to width slightly greater than that of anticipated defect. Medial incision extends from point above site of proposed incision along base of nose to point low on nasolabial fold. Superior pedicle taken thicker than thin inferior one. Lesion may be widely excised t this point and mucosa sutured t skin. If extent of neoplastic lesion is doubtful, reconstructive procedures should be deferred until margins of surgical specimen are found adequat on histologic examination. *B* \ Incision made 2 weeks later This area only is elevated to secure division of entire inferior pedicle *C* single pedicled flap based superiorly is elevated and adjacent cheek widely undermined 2 weeks later *D* flap is folded upon itself and sutured to nasal skin externally and to nasal mucous membrane internally Cheek defect s closed primarily (Courtesy of Hagerty R F and Sm th W Am. Surgeon 24 506-510 July 1958.)

the surgical specimen If the lesion can be readily encompassed the bipedicled flap is elevated first and this area sutured Seeding of the cheek wound is thus prevented should the neoplasm be transected in the initial procedure. Should such a transection of the malignancy occur after elevation of the pedicled flap the site of the residual carcinoma can be determined from hi ologic study of the marked surgical specimen and further - section performed This method may complicate the plar ' reconstruction but is vastly preferable to inadequate or n harmful cancer surgery

Nasolabial fl. s may be used in a variety of ways depend

ing on the extent of the defect to be corrected Their use extends from small flaps rotated into the defect in one operative procedure to large, delayed flaps which are to be folded on themselves to provide for the entire reconstruction of the lower half of one side of the nose or lined with a split thickness graft for repair of the defects extending to the opposite side of the nose Figure 219 shows some technical aspects

Experimental Observations of Repair of Extensive Defects of Skull with Split Rib Grafts J J Longacre and G A deStefano* (Cincinnati) in trying to determine the various factors that govern repair of a large cranial defect used rhesus monkeys Rib graft was chosen because it has been shown to have inherently greater power of osteogenesis than any other bone in the body and also will regenerate The rib was split with a blade to provide more substance for reconstruction and to open the cancellous trabeculae for maximal survival of osteoblasts and osteocytes Splitting the rib also makes it more malleable so that it can be contoured to fit any type of cranial defect.

Follow up x ray study of the reconstructed defects showed no change during the first 7 10 days but within 19 days fuzzy demineralization was noted as the result of beginning vascularization of the split rib grafts Within 42 days the outline of the split rib grafts and also of the returned bone plate were less distinct as vascularization progressed At this time new bony matrix was noted in the interstices between the grafts At 3 months the rib grafts were firmly secured by diffuse osteogenesis though mineral content was not great By this time the new bone had bridged the gap between the skull and ribs and between the rib grafts On the control side the bone plate appeared partially fused to the host skull but there was no regeneration of bone on the other edge of this defect

Within 1 year density of the split rib grafts approached that of the normal skull and only vague outlines of the original ribs could be seen blended into a firm solid bone plate The control defects in all cases showed little evidence of osteogenesis At the end of 1 year in a few monkeys there was a small amount of new bone formation (lipping) and rare small spicule formation on the dural side In 1 instance only there was a thin plate of bone on the dura which fractured on

(2) Plast. & Reconstruct. Surg. 21 372 388 May 1958

slight digital pressure In the first of the animals in which the biopsy specimen was removed by chisel instead of trephine, there was disturbance of the rib grafts along with fracturing of the skull The fracture line and separation of the normal suture lines after this traumatic maneuver did not show any calcification 1 year later as against evidence of healing with callus formation of the fractured and disturbed split rib grafts Some fracturing was also noted in a few animals from which biopsy was taken by trephine In the animals undisturbed by biopsy there was blending of the rib grafts within the solid matrix of new bone.

When a layer of polyethylene was placed about the split rib grafts definite interference with healing occurred leading to partial absorption of the grafts and failure of firm fusion on their ends to the skull About the polyethylene a large amount of clear fluid was found This failure of fusion is in striking contrast to the firm fusion between one piece of rib graft and the surface of the opposite side of the skull

When the monkeys were killed 10-13 months after operation and the skulls carefully examined there was no evidence of irritation to the underlying brain tissue and no adhesions between the dura and the pia arachnoid None of the animals had epilepsy postoperatively even though biopsies had been taken in the interval There was little evidence of new bone formation in the control trephine defects on the opposite side of the skull of each animal or in the trephine defect created by removal of the biopsy specimens The striking finding was the interference of polyethylene with vascularization of the graft and consequent failure of osteogenesis There was regeneration of each rib that was resected.

► [As a result of the authors efforts one will now be able to correct many of these massive defects in a proper and physiologic manner with the patients own osseous tissues The article should be studied by all who deal with this problem.—Ed.]

Further Observations of Behavior of Autogenous Split Rib Grafts in Reconstruction of Extensive Defects of Cranium and Face J J Longacre and G A deStefano[3] (Cincinnati) used 118 split rib grafts to repair extensive defects of the cranium and facial skeleton in children and adults Though many of the grafts were placed into areas that had been previously infected and from which tantulum plates or banked bone had been extruded and though in a number of instances

(3) Plast. & Reconstruct. Surg 20:281-296 October 1957

the infection was reactivated there were no extrusions of the grafts In 1 instance a large collection of seropurulent mate rial was aspirated from under the flap and around the grafts Antibiotic therapy was started and the grafts remained via ble not even one small sequestrum was extruded

In bilateral defects the degree of osteogenesis was greater on that side having the least scar tissue in the recipient bed In 1 instance a postoperative hematoma was absorbed en tirely except for a small area 3 cm across in the most de-pendent portion of the wound Six months later this area was re-explored and the end of one graft was found lying free in a pocket of serum On histologic section this portion of the rib was found to be dead whereas the remaining part and the other rib grafts were viable Thus serum penetration can keep the osteocytes alive merely for a short period and then only those cells on or near the surface of the trabeculae His tologic examination of a split rib graft removed at 1 week showed that most of the cells had disappeared from the lacu nae, and the reticular tissue between the trabeculae and in Volkmann s canals had fragmented A few cells appeared via ble on the very periphery of the graft. When the recipient bed is relatively free from scar rapid vascular penetration oc-curs between the trabeculae There was rapid ingrowth of blood vessels along the Volkmann and haversian canals within 2 weeks after implantation which was followed by bone absorption within 24-48 hours as noted by the pres ence of Howship s spaces containing osteoclasts

In a 2 week biopsy active ingrowth was noted of ex tremely cellular granulation tissue The cells were still ab sent on the lacunae and there was active osteoclastic resorp-tion. In the 5 week biopsy there was active ingrowth of loose vascular connective tissue between the trabeculae and into Volkmann s canals. One small area of necrotic marrow was present in the center of the graft Though the osteocytes had disappeared from the lacunae in the interior of the trabecu lae, on the surface of all the trabeculae exposed to the vascular connective tissue were many osteoblasts actively laying down new osteoid substance. A number of the trabeculae of bone were joined with newly formed bone. This process was most active where the graft was open and the vascular sup-ply greatest. Simultaneously as the osteoclasts were remov

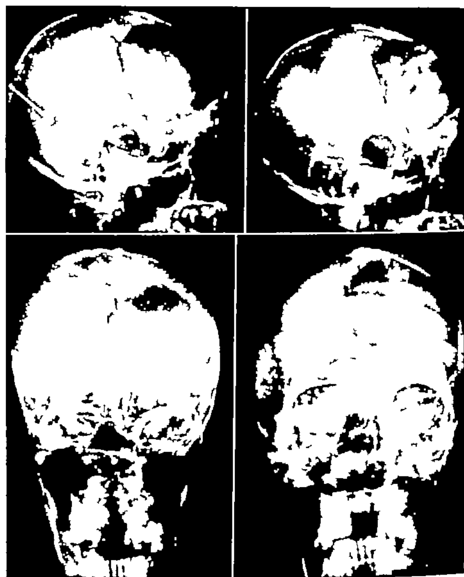


Fig. 220 (left).—Extensive defect involving frontal and parietal areas in man, 70.
Fig. 221 (right).—Reconstruction attained with contoured rib grafts.
(Courtesy of Longacre, J. J. and DeStefano, G. A. Plast. & Reconstr. Surg. 20:281-296, October 1957.)

ing the dead bone there was active new bone formation by the osteoblasts.

In the 6-month biopsy the rib attached to a portion of the skull showed a flat trabecula of relatively normal bone bounded on the outer side by normal tissue and then another piece of relatively normal bone and between the two newly formed bone with areas not yet calcified, i.e., presumably os

eoid still with some rather large osteoblasts It is not pos
ible to say whether this new bone arises from the rib or the
kull

Clinically within several weeks after the split rib grafts
d been inserted there was no bulging of the cranial con
its beyond the skull and the repair was firm After 2
nths x ray study revealed evidence of vascularization of
new bone grafts and spotty demineralization In succeed
months there was evidence of recalcification and spread
ing bone formation At the end of 1 year there was evidence
of new bone bridging between the skull and the rib grafts
and between the grafts themselves On exploration the graft
and host bone were joined by a band of tissue resembling a
cranial suture The appearance suggested that new bone was
being formed slowly by metaplasia from stroma along the
line.

Clinically the skulls in these children developed at a nor
mal rate Within 2 years the layer of new bone had thickened
into large bony plates and only vague vestiges of the original
ribs could be observed The contour and firmness of the re
pair were excellent. Split ribs used to repair defects of adult
skulls showed similar good results (Figs 220 and 221)
Among 94 full length split rib grafts to reconstruct 14 exten
sive defects of the cranium no epileptic seizures developed
in the patients during 5 36 months of follow up

MISCELLANEOUS

Surgical Repair of Lupus Vulgaris was studied by Thomas
Rees[4] (New York) The conservative treatment of lupus
lgaris has included all the known antitubercle measures
h as rest high-calorie diet heliotherapy carbon arc lamp
apy caustics electrocoagulation etc More recently
e doses of calciferol alone or combined with streptomy
in have proved effective. Isoniazid currently in use prom
ises to eradicate lupus as a clinical entity This drug should
be given before surgery is undertaken and maintained until
a healthy defect is present. High levels of nutrition and gen

(4) Plast. & Reconstruct. Surg 20 147 154 August, 1957





Fig 222 (above) —Typical involvement by lupus of nose and cheeks, with destruction of nasal cartilage and lining Patient had history of skin lesion for 28 years, previously treated with light and unknown dosage of radium. Cheek lesions were excised in 1950 and reconstructed with free whole-thickness skin grafts.

Fig 223 (left) —Subtotal nasal reconstruction with immediate forehead flap done in 1952.

(Courtesy of Rees, T D. Plast & Reconstruct S rg 20:147 154 August, 1957)

eral hygiene should be maintained throughout treatment. X rays are made preoperatively

Surgery aims at eradication of all remaining diseased tissue including areas of irradiation and repair of the resulting clean defect. This often is not easy because pathologically the lesion is noted for small areas of tuberculous activity in a clinically quiescent lesion Secondary infection may be an

initial feature. All excised tissue should be serially sectioned for histologic study If carcinoma is found an adequate operation must be undertaken with regional node dissection if necessary To remove all diseased tissue a mutilating operation is often necessary no chance of cure and ultimate reconstruction is possible with anything less

The local problem of repair is most often that of subtotal or



Fig. 224 —Final result and present appearance of same patient. She has remained free from disease. No carcinoma in pathologic specimen. (Courtesy of Rees, T D Plast & Reconstruct. Surg 20 147 154 August, 1957)

total nasal reconstruction Defects of the lips cheeks and lids (ectropion) also must be dealt with Whole thickness pedicle repair is most often indicated because of loss of supportive bone cartilage structures and mucous membrane. Pedicled tissue has the added advantage of furnishing new blood supply In general free skin grafts do poorly and suffice only as temporary coverage and for repair of ectropion Free whole thickness (Wolfe) grafts can be used to repair superficial lesions when underlying structures are not involved. Delayed healing of suture lines is usual and should be expected. Surgical results are illustrated in Figures 222 224

Lymphatic Edema Evaluation of Surgery in Its Treatment. Rainsford Mowlem[5] (London) outlines the mechanics of edema production The lymphatics of the limbs are appar

(5) Am. J Surg 95 216–22, February 1958

ently mainly concerned with drainage of the skin and subcutaneous tissues Although this function is also attributable to the venous system little overlap appears between the two and the two systems probably have diverse duties. Though knowledge of the distribution and functions of the lymphatic system is lacking clinical edema probably arises from three main causes (1) increased formation of tissue through errors in the arterial tree most often the result of generalized or systemic lesions (these do not call for local surgical treatment) (2) failure of absorption due to obstruction of or damage to the venous mechanism and (3) failure of absorption by the lymphatic tree The progress of edema as commonly found in postoperative obstruction and in idiopathic edema is similar but apparently the causal mechanism is different and different methods of treatment may be indicated. Thus the two conditions are considered separately

Various methods for relief of obstructive edema have been suggested such as use of strands of silk thread beneath the skin throughout the length of the limb use of nylon or polyethylene tubing excision of a strip of deep fascia or transference of a bridge or wick of skin and subcutaneous tissue containing linear lymphatic trunks to create a bypass to drain the affected limb into an unaffected area If a satisfactory bypass can be obtained this treatment will prevent worsening of the edema. If there is residual fibrosis provision of an alternative drainage mechanism will only partly cure the swelling of the limb

Since in idiopathic edema it appears that the whole lymphatic system in the affected limb is faulty attempts to provide an efficient drainage mechanism appear useless. Treatment must be directed toward increasing the patient s comfort and mobility by reducing the thickness and bulk of the subcutaneous tissue in the affected area Many operations have been described but these are in essence only variations in technic the choice of which must be dictated by conditions found at operation It may be best to split the skin of the limb leaving it attached as flaps which are sutured into position after excision of the entire subcutaneous tissue. In other instances the limb as a whole may be flayed from the knee down and the whole of the integument converted into a free graft to be applied immediately At times especially

when the deep fascia is markedly fibrotic, grafting may be delayed 10-12 days.

Much more work is needed to discover the role of the lymphatic system in the limbs, to throw light on the mechanism of protein clearance from the tissue fluid and to determine to what extent accumulation of this protein is a cause and to what degree it may be the effect of edema in the limbs. Added knowledge may provide a new approach to the problem.

Osteomyelitis of Jaws in Infants. Paul Natvig and Reed O. Dingman[6] (Univ. of Michigan) report 6 cases in children under age 2. The mandible was affected in 5 and the maxilla in 1. Hematogenous dissemination was the most likely cause in all these cases.

The infant with involvement of the maxilla showed marked swelling of the periorbital tissues and cheeks, with pronounced redness and pus. Those with involvement of the mandible showed swelling of the cheeks and tissues over the body and ramus of the mandible and parotid region. All presented the classic symptoms of infection, leukocytosis and fever. Poor nutrition and anemias were noted almost consistently.

Treatment of choice is use of antibiotics until specific organisms can be isolated and sensitivity studies carried out. Incision and drainage are mandatory if a fluctuant abscess develops and careful sequestrectomy should be done when loose necrotic bone is present. Early radical surgery only leads to spread of infection and greater loss of tooth and bone structure. Careful sequestrectomy permits maximum reconstitution of mandibular and maxillary contour.

Surgical Management of Dupuytren's Contracture. Archibald McIndoe and R. L. B. Beare[7] (East Grinstead, England) discuss the clinical features of Dupuytren's contracture in relation to treatment. Four stages of the disease are recognized. Other than radical surgery, nothing will cure the patient with an established Dupuytren's contracture and early operation is important.

TECHNIC.—Any general anesthesia is permissible which will allow temporary hypotensive anesthesia during the final stages of operation. The hand and arm are exsanguinated by use of an Esmarch bandage, and a pneumatic tourniquet on the upper arm is inflated to

(6) Am. J. Surg. 94 873-876, December 1957.
(7) Ibid., 95 197-201, February 1958.

280 mm. Hg The palmar incision is made with a small blade skin hooks are applied to the edges and the palmar skin is undermined until the whitish nodular Dupuytren s tissue plus some apparently normal aponeurosis and palmar fat are exposed. A longitudinal incision is then made into the lateral margin of the aponeurosis and carefully deepened until a neurovascular bundle is seen The bundle is retracted with a blunt hook and then freed from the fibrous tissue as far as the base of the finger The aponeurosis is divided transversely at its proximal end and tissue forceps are applied, turning the cut end forward toward the fingers. The Z incision is made carefully through the skin of the involved finger and the triangular flaps are undermined exposing the fibrous cord beneath The involved fibrous cords are dissected out of the finger and pulled down into the palm by tunneling beneath the bridge of skin which lies between the palmar and digital incisions. Failure of extension after adequate incision implies the presence of permanent changes in the finger joints which will only be damaged further by forcible extension. The patient s blood pressure is lowered by a hypotensive drug and the tourniquet is released The skin incisions are sutured with interrupted silk stitches with the hand held high by the assistant. A small rubber drain is inserted at the ulnar end of the palmar incision A pressure dressing is applied directly to the palm and between the fingers The hand is wrapped in cotton wool and a crepe bandage is put on firmly No splinting is used The hand is kept elevated on a pillow during the immediate postoperative period. Dressings are removed after 3 days for inspection only and a lighter dressing is applied Stitches are removed in 10-14 days and from this time active movements are encouraged

Complications encountered are hematomas loss of skin, delayed function return and vascular spasm

► [The authors clearly and concisely describe the management of a surgical condition which has been quite controversial. They have suggested several worthwhile innovations in their approach. An excellent article for all hand surgeons.—Ed.]

Current Therapy of Elephantiasis of Lower Extremity is outlined by Thomas J Baker Jr[8] (Univ of Missouri) The patient must be hospitalized and kept for at least 2 weeks at absolute bed rest with the leg elevated to reduce edema as much as possible The extremity should be cleansed daily with surgical soap and rid of any infection that might interfere with the take of skin grafts

Under general anesthesia the involved areas should be excised down to and including the fascia overlying the muscles. Skin covering the sole of the foot and Achilles tendon should be preserved The denuded area should be resurfaced with split thickness skin grafts taken from the opposite leg abdomen or from the excised skin if it is suitable Absolute be-

(8) Am J Surg 96 84-87 July 1958

mostasis is essential The leg should be carefully dressed and placed in a posterior splint for immobilization It should be kept elevated for several days to prevent edema and to aid in the take of the grafts

The first dressing is done on the 6th or 7th day Between



Fig 225 (left) —Chronic lymphedema of 20 years duration.
Fig 226 (right) —Result 6 months postoperatively Functional result excellent.
(Courtesy of Baker T J J Am. J Surg. 96 84-87 July 1958.)

the 14th and 21st day the whirlpool tank is used to aid in removing any crusts that remain on the leg and to accelerate return of function No walking or standing is permitted until 30 days after the grafts have healed and all raw areas are gone Results of this treatment are illustrated in Figures 225 and 226

Ambulation should be started slowly with frequent rest periods Elastic support must be worn constantly The patient must understand that he must adjust to a new way of life after such an operation and this includes the

elastic support for many months maybe years, frequent periods of rest with the leg elevated standing for prolonged periods and constant care to prevent injury to the limb

Delineation of Parotid Gland by in Vivo Staining was performed by Herbert J Forrest and David W Robinson[9] (Univ of Kansas) Preliminary staining of the parotid gland aids in separation of the facial nerve from parotid tissue Because the parotid tumor is not stained an adequate rim of stained gland tissue can be easily identified around the tumor during the operation Thus total parotidectomy can be assured if desired Preliminary staining was used in 9 parotidectomies The operative incision healed well in each instance and no postoperative complications occurred.

TECHNIC.—After the anesthetic was started and the intratracheal tube was in place the orifice of Stensen s duct in the mouth on the side of the tumor was identified. Stensen s duct was dilated for a depth of 1 2 cm., using a small salivary duct probe. A no 22 polyethylene tube was inserted into the duct, by using the left hand to hold the mouth open and stretching the cheek. A smooth thumb forceps in the right hand was used to insert the polyethylene tube into the dilated orifice A syringe containing 4 cc. sterile 1% aqueous methylene blue was attached to the tube. This solution was slowly injected into the parotid gland. Usually 2.5 3 cc. was sufficient to distend the gland The polyethylene tube was held steady in Stensen s duct as the dye was injected. By observing the orifice of Stensen s duct, it was possible to tell when the gland was full from back leakage of dye around the tube

Limitations of Multiple Excision. W H Steffensen and E F Worthen[1] (Grand Rapids Mich) state that multiple excision should be considered for treatment of large facial lesions in which simple excision and closure are not possible. It may be combined with other basic plastic surgery procedures such as Z plasty and advancement of rotation flaps Caution must be used not to distort critical areas such as the eyelids nostrils and mouth Large lesions involving these areas cannot be serially excised without distortion unless other methods are used in combination. Large forehead lesions so removed may result in distortion of the hairline and eyebrows

Distortions resulting from many operations on vital areas of the face are difficult to restore to normal Occasionally when the stretching principle has reached its normal limit,

(9) Plast. & Reconstruct. Surg 20 311 314 October 1957
(1) Am. J Surg 95 237 238, February 1958.

one may gain more by the use of a rotating flap A Z plasty frequently improves a tight or poorly placed scar A Z plasty may often be used in transferring normal tissue to a critical area while simultaneously shifting the pathologic tissue into another area which permits its excision in one or more stages

A stretched scar resulting from multiple excision may be revised by excision and slight undermining which permits the skin edges to retract nearly to their original location before removal of the lesion This is due to the inherent response of stretched skin to pull on its elastic fibers

Use of multiple excision over bony prominences in young children may result in retardation of growth by increased tension The authors caution against trying to accomplish the supernatural with extensive lesions

► [This article fills a hiatus for those of us who have been intrigued with the application of "multiple excision." In many cases dramatic results can be produced through the application of this fundamental surgical principle on the other hand, the anticipated results frequently are not produced, and the surgeon finds himself in a morass of unexplained complications which rob him of good results Much of this is exposed and clarified by the authors.—Ed.]

Tattooing the Cornea. Kenneth Pickrell Nicholas Georgiade Joseph Kepes and Robert Woolf[2] (Duke Univ) developed a method for injection of permanent pigment into corneal scars The method was used in over 100 patients who had congenital corneal opacities posttraumatic scars postoperative conjunctival flaps operative defects of the iris heterochromia polychromia and congenital colobomas No complications developed and the results were good. Because there are no lymphatics in the cornea, there is no diffusion dispersion or change in the color of the pigments implanted into the cornea Some of the patients had no change in the color or size of the pupil or iris for over 10 years (Fig 227) Tattooing may improve visual acuity by reducing the area of an abnormal cornea through which dispersing pencils of light pass The tattooed area will absorb the annoying peripheral rays Even though an eye may be blind tattooing will conceal a conspicuous deformity

TECHNIC—The size of the iris or limbus (the junction between the iris and conjunctiva) should be determined by measurement with dividers as compared with the normal eye. The size of the reconstructed pupil should be that of the normal pupillary opening under ordinary lighting conditions Diameter of 4 mm is a pleasing

(2) Am. J Surg. 95 246-254 February 1958.



Fig. 227.—Penetrating wound of right eye received in early childhood resulted in vision loss. Because eye was blind, patient was not candidate for transplant operation. Prosthetic shell could not be worn because scarred corneal surface was irregular conical in outline and contained calcareous deposits. Eye was tattooed in two sittings over 11 years ago. (Courtesy of Pickrell, K., et al. Am. J. Surg. 95:246-254 February 1958.)

size. The pupil size should be determined before operation because the analgesic or anesthetic agent or the intense illumination of the operating room might cause variability in the size of the pupil. After satisfactory anesthesia has been obtained a speculum is inserted on each side to visualize both eyes simultaneously. The eye to be tattooed is immobilized by inserting a silk suture in tranverse direction into the insertion of the superior and inferior rectus muscles at 6 and 12 o clock. Insertion of each muscle can be felt accurately with tissue forceps about 7-8 mm. from the limbus. Mosquito clamps applied near the ends of the sutures will help the second assistant to keep proper tension on the "guy wires" to fix and station the eye in proper position as the tattooing progresses. Mosquito clamps or fixation forceps may be used to grasp the conjunctiva to immobilize the eye and should be placed about midway between the limbus and each canthus, at 3 and 9 o clock. These clamps may cause tiny perforations, serrations or tears in the conjunctiva. Therefore they are not released until the operation ends to prevent pigment from being washed into or from entering the conjunctiva. The size of the iris and pupil determined previously is now rechecked with the normal eye by careful measurement with dividers.

The basic color of the iris is obtained by the artist, who mixes small amounts of several dry pigments in a porcelain palette and adds saline solution until a thin paste is obtained. A small amount of the mixed pigment is spread thinly on the gloved finger and compared with the color of the iris on the normal side. Because the cor

neal scar is white or very light gray the basic color should be slightly darker than the normal iris The exposed corneas should be "buttered" with a thin layer of petrolatum applied with a finger or cotton applicator

With a no. 1 or no. 2 tattoo needle, the periphery of the cornea or limbus is carefully outlined with the basic color pigment. Implantation of the pigment should begin at the limbus, working toward the center of the eye in radial direction. The needle must be inserted at an angle of about 45 degrees so that a line of pigment rather than a tiny spot in or beneath the epithelium is produced. Injection of the pigment from the periphery to the center will assimilate accurately the striations of the normal iris. A small amount of pigment is taken onto the needles after each insertion by dipping the needle points into the pigment The eye must be fixed or immobilized so that the needles can be inserted to the proper depth and the limbus defined accurately The operator may find it advantageous to change his position occasionally from the sides to the head of the table rather than to rotate the eye. Additional iris color or tone is added in radial fashion until the scarred area is homogeneous in appearance and color The eye is flushed repeatedly with saline and wiped gently with applicators or wisps of cotton moistened with saline to visualize and assay progress. Over 100 needle insertions may be necessary Any pigment that enters that portion of the scar encroaching on the pupillary area will later be covered with black. Care should be taken to avoid entering the anterior chamber The cornea will tolerate a surprising amount of trauma and injection of the pigment need not be stopped until a nap or fuzzy surface, like buckskin, has developed. Visible areas of scarring are tattooed until the scar is covered completely and the iris is homogeneous in color If a conical cornea is being tattooed caution is required to avoid entering the anterior chamber If the chamber is entered there will be immediate escape of aqueous humor and the globe will become soft so that the tattooing must be ended.

In inserting the pupil a Keyes cutaneous punch or corneal trephine is used, of the size corresponding to that of the predetermined pupillary measurement. A circular incision is made in the cornea to define the limits and periphery of the pupil A pupillary trough is made by rotating the Keyes punch in to-and fro manner between the thumb and index finger The cornea must not be incised deeper than about 1 mm. Into this circumscribed area, concentrated black pigment is injected. Up to this point the eye will lack luster After the pupil has been inserted definite brilliance and sparkle are obtained by inserting flecks of orange yellow blue, green or brown, as observed in the normal eye. The eye is flushed repeatedly with saline solution, using a bulb or ear syringe to wash away excess pigment, and wiped dry with cotton wisps or applicators Penicillin ophthalmic ointment is placed in each eye, the fixation sutures or clamps are removed and the speculum is released. Both eyes are covered with a cotton pad or gauze dressing

Pain is never pronounced codeine will be adequate to relieve the scratchy discomfort. Unless both eyes are covered, photophobia may

be pronounced. Although there is considerable injection of the eye for about 1 week discomfort is usually not present after the 2d or 3d day Use of OpH* relieves congestion and scratchy sensation. Many patients are discharged from the hospital on the 2d or 3d day (wearing a patch over the tattooed eye and dark glasses to control photophobia) and followed on an ambulatory basis for about 1 week.

Tattooing in a single operation may not always be possible. Skip areas may become apparent within several days. These areas are not due to fading but to an insufficient number of injections.

Although the authors inserted more pigment to correct skip areas within a week or two after the initial operation, it is better to wait a month or 6 weeks if considerable additional pigment is needed. The second stage is similar to the first The basic iris color is added until no areas of untattooed scar are visible. With a Keith needle dipped in the pigment, the iris is flecked with orange, yellow blue, green, red or brown to match the colors of the normal eye. The limbus or periphery of the iris is a diffused, circular blue-gray line. This effect may be produced by tattooing the periphery with blue pigment to which black has been added This requires some skill in mixing and injecting to obtain the desired result. The effect of the light zone of pigmentation surrounding the pupillary area may be achieved by injecting light pigment into the rim of the pupil.

► [Because of the infrequency of complications involving the eyes which require tattooing little is known of the problems which confront the patient and the physician. The patient in need of this type of surgery is deeply concerned, and frequently the inability to procure relief causes severe psychic disturbance. The authors have devised a satisfactory operation. Gratifying results are obtained with minimal surgical effort. It is a valuable addition to the armamentarium of the plastic surgeon —Ed.]

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